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The Government and Telegraph Lines

Speculation as to what the Washington administration may or may not want to do to promote government ownership of telegraph and telephone lines is not warranted by anything that has been determined up to this time. The government has had its attention fully occupied by the tariff and currency bills and, even if it wanted to give consideration to an extension of federal control over other activities, it has not had the time to do so. There is no present ground for the report that the administration wants to undertake the ownership and operation of these utilities. There is not a public sentiment in favor of such a course. There are strong and definite public reasons why advocates within the administration of such a radical step should not be allowed to determine the policy of the government in the matter. The cost of the telephone and telegraph properties combined would involve an enormous and unnecessary increase in the national debt. The cost of the lines engaged in interstate business only would require a much smaller investment but it would mean a mixture of government and private ownership that would be fatal to the high quality of service demanded by the public. The acquisition of the telegraph lines without the telephone lines, or of the telephone lines alone, would put the government in competition with the properties not acquired. It would mean that either the unacquired properties and the government would have to agree on rates or that one competitor would feel the stress of competition. Such a contingency as government competition with privately owned telegraph or telephone lines is remote; but it is well to point out that some of the rumors now being circulated undertake to commit the government to a policy that is not far from the seizure of private property without due process of law and without proper compensation. Those who have proper property rights should be protected in them against a policy of confiscation or dangerous approach to that discreditable course. The government should be free from any suspicion of operations of this character.

Cheap Energy Everywhere

An inspiring picture to those engaged in electrical energy supply service and who also have the general welfare of humanity at heart has frequently been drawn by Mr. Samuel Insull, who is now, and has been for some time, engaged in the practical application of the theories which he advocates concerning the advantage of centralizing electrical energy production in a few large and economical generating plants. It is the central-station man's ideal to furnish all of the energy used in a community. Toward this end the central-station industry has been working for years. This ideal is gradually coming nearer realization. With cheap electric energy available at any point in a large territory for all purposes, including electric railways, many present social and economical problems of crowding and congestion of population and traffic will be solved. By making it easy to establish factories in the country where crowding of population is not necessary, the costly congestion of passenger and freight traffic now common in our large cities will be no longer an economic necessity. It certainly seems that cheap electrical energy supply plus good transportation offers most of the facilities for convenient transaction of business now found in large centers. As has often been pointed out, the existence of water-power is by no means always essential to the production of cheap electric energy in these days of large steam generating stations, in many of which the cost of fuel per kilowatt-hour has been reduced to a point where it is only a small fraction of the total delivered cost.

Uniformity in Rate Making

To a person ignorant of the operation of electrical supply systems but familiar with the uniform charges made for gas at so much per 1000 cu. ft., whether used for domestic lighting or cooking, the distinction made by central stations in the charges for electrical energy for lighting and for motor service is a subject of considerable mystery. However, little difficulty is experienced in explaining to a person of average intelligence that gas can be produced at a convenient uniform rate and stored at small cost for consumption whenever needed, while electricity can be stored only at enormous expense and, for reasons of economy, must be produced at each moment at the exact rate of the instantaneous demand. The public would be justified in insisting upon uniformity in the charge per kilowatt-hour for electrical energy used for all purposes provided such charge were made high enough to cover the cost of an adequate electrical energy storage system. Without such a system or the added charge equivalent to the cost of installing and operating it, the rate for energy for each class of customer can best be placed at a value to cover properly the average cost of production during the hours of demand by that class. Uniformity in rates has another and more significant meaning in connection with the subject of rate schedules—a subject to which the National Electric Light Association has given much attention. For the past two years the rate research committee, one of the most active of those belonging to the N. E. L. A. organization, has urged upon the membership the desirability, if not the necessity, of adopting an absolutely uniform method of presenting their rates. No attempt has been made or should be made to render the

rates in one locality equal to those in another where equipment cost, labor, fuel supply and distributing problems are different or to cause any one company to charge the same rate per kilowatt-hour for energy, independent of the customer's time of demand, load-factor or diversity-factor. That the suggestion of this committee should be widely adopted is being appreciated more and more by progressive central-station managers and public service commissioners. It would be well for the public-utility companies, which more than any others will benefit by the adoption of a uniform method of rate-making, to hasten the coming of the day of uniformity in the presentation of their schedules rather than be placed in the position of seeming to oppose a healthy change in the attitude of the companies toward the public for which the time is now ripe.

Incandescent Head-Lamps

We print this week three articles on head-lamps and their properties, by Messrs. Charles R. Sugg, A. R. Dennington and L. C. Porter respectively. The subject, considered broadly, is of great importance from various points of view. If we consider for a moment the point of view of purpose, a head-lamp on any vehicle is installed to enable an obstacle to be detected beyond the stopping distance. The greater the speed of a given self-propelled vehicle, the greater, as the square, becomes the distance which must be traversed before it can be brought to a full stop. Hence the importance of long-distance visualization in relation to high speeds. Such visualization requires a certain amount of light to be thrown upon the obstacle. At long ranges this calls for intense luminous beams, such as arc lamps can throw when provided with suitable reflectors. Nevertheless, if the intensity exceeds a certain value, the range of effective visualization may cease to be increased and may even be diminished, for the reason that the light reflected from dust or water particles in the beam, to say nothing of casual reflections from poles and houses on land or from wave surfaces at sea, may greatly reduce the optical sensitiveness of the eye on account of the glare.

As is pointed out in the articles here considered, an ideally perfect projector would have constant luminous flux density in a uniform parallel beam at all practical distances, a condition that is neither actually realizable nor practically desirable. In practice any head-lamp may be considered as producing a slowly diverging beam. Strictly speaking, the virtual source of this diverging beam lies on the axis of the head-lamp and, at distant points along that axis, is equivalent to a straight luminous filament, like a Nernst filament, supported along the axis and passing through the center of the arc or incandescent source. The brightness of this equivalent luminous filament, or axial cylinder, reaches a maximum near to and ordinarily slightly behind the center of the actual source. Under these conditions the luminous intensity in any direction near to the axis falls off nearly inversely as the square of the distance from the head-lamp, when the distance is so great that the length of the equivalent luminous filament becomes relatively insignificant; so that the head-lamp, at considerable distances, approximates in photometric behavior to a point source. Nevertheless, as a matter of principle, and as an obvious precaution against misconception, the observed candle-power should be expressed as apparent candle-power at the actual distance measured from the focus in the lamp.

The Phase-Converter Locomotive

The use of an induction motor as a phase converter is not novel so far as laboratory experiments are concerned, for it has long been considered a very convenient device for shifting an emf into any phase position relative to the primary emfs. With a polyphase primary current and a stationary but adjustable secondary winding, emf of any time-phase position can be taken from the secondary by giving the latter a suitable mechanical position. The rotating field cuts the secondary winding and generates emfs in it. Exactly the same result can be secured, and for the same reason, in a tertiary winding on the primary core, usually stationary, by producing a revolving field by the combined magnetizing action of the single-phase primary magnetizing current and the currents produced in the secondary by its motion through the primary flux.

The difficulty with a simple phase converter is that such a round-about magnetizing process does not, except at no load, produce in the two or more phases of the load circuit equal voltages and a time-phase displacement corresponding to the space-phase displacement of the stator windings. In fact, the unbalancing is so bad as to render the device useless for commercial purposes, where it must be well loaded to render it efficient, although it might be used to balance the voltages and shift their time-phase positions automatically.

The phase converter has come into prominence recently because it bids fair to make the polyphase motor applicable to railway service whenever its constant-speed characteristics are desirable or at least unobjectionable; that is, in slow-speed heavy service. Overcoming the inherent difficulties of commutation in the series type of alternating-current motor is expensive and the motor is heavy. The induction type is inherently cheap in spite of the fact that the only equipments of the kind so far constructed in this country were not so. As soon as polyphase railway motors are adopted on a scale great enough to permit the motors to be manufactured in large quantities they will surely be built at a reasonable price. They are compact, simple and rugged in construction. They permit the use of regenerative control with consequent saving in energy and in brake-shoes and a decrease in the danger of operation. Even if the phase converter weighs enough to offset the decreased weight of motors, there still remain the other favorable features, always provided that constant-speed characteristics are desirable.

It may be safely assumed that any system of electric traction advocated by experienced engineers can and will be made to operate with entire satisfaction from the technical standpoint. The final decision in favor of one system or another will be given largely on a basis of cost. The elements of ultimate cost are not all contained in the locomotive, but involve the transmission and distributing system, with provision for reliability, protection and non-

interference with other circuits and the power house. Account must also be taken of maintenance and obsolescence, including in the latter the possibility of new inventions and applications which may necessitate the scrapping of equipment long before it is worn out. Examples are fresh in our memory of expensive equipment discarded soon after installation because it was too heavy or too inefficient. Each new commercial experiment in electric traction is made in the expectation that the new apparatus is to meet the service requirements of capacity and reliability at a minimum of cost.

Inductive Interference

The comprehensive investigation of inductive interferences between transmission lines and parallel telephone and telegraph circuits carried on during the last eight months by the Railroad Commission of California, as reported in another page of this issue, marks a new and interesting departure in the work of public service commissions. The problem attacked is an old and troublesome one, dating back to the earliest days of electric-railway development. Upon the advent of the 500-volt direct-current traction system, in the late eighties, the single-wire ground-return telephone lines of those days were found to be very sensitive to induction from the variable-frequency pulsations in the trolley current caused by commutating action in the motors. Telephone users, indeed, became familiar with the variable-pitch note of the successive commutator bars passing under the brushes, rising in pitch and diminishing in volume as a car started from rest and accelerated to full speed. The telephone companies found themselves under the physical and legal necessity of resorting to the use of transposed metallic circuits, a step in evolution which was no less necessary from the standpoints of both overcoming cross-talk between long parallel grounded circuits and establishing commercial long-distance telephony.

Although the chief difficulties were thus temporarily relieved, the open-coil series arc generator, with its complex pulsating-current wave, soon became standard for street lighting, making use of the open-loop series distribution system. Inductive interferences from this source, where the exposures were severe, were troublesome in the extreme, and for a time the only remedy appeared to be complete separation of telephone and lighting systems. Before further remedial measures were generally understood, the alternating-current constant-potential system of distribution made its appearance and inductive interferences grew still more troublesome. The supersession of the direct-current series arc system by the alternating-current series system certainly did not relieve the situation, but probably magnified the troubles, if anything. Contemporaneously with these developments the art of transmitting energy over long distances at high pressures was moving forward at a tremendous pace, and interferences from such systems, although limited at first in the number of instances, added to the difficulties of maintaining commercial telephony.

Meantime much study was devoted to the situation, and the telephone companies found it possible, about a decade ago, to lessen the interferences by the application of new principles in transposition, although the remedy by no means fitted all cases. The severity of disturbance was also much lessened by changes in the practice of power and lighting companies in grouping phase wires closer together and adopting the closed-loop system of series distribution with lamps in alternate sides of the circuit to balance the potential to earth. Transpositions were also adopted to a limited extent in distribution and transmission systems. But the most serious cause of disturbance, by far has been the alternating-current single-phase traction system, of which the electrification of the western terminus of the New York, New Haven & Hartford Railroad forms the most conspicuous example. After much work on the problem, quite satisfactory relief was devised for telephone lines in cable by the use of neutralizing transformers, but open-wire lines, on account of their variable insulation, still present a vexatious problem. The telegraph companies, with their single-wire earth-return circuits and their sensitive multiplex systems of transmission, have also suffered severely. Unfortunately, the great amount of private research work carried on in attempts to meet these various situations is, for commercial or legal reasons, locked up in private files and not available to the engineering profession. It is therefore a matter of congratulation that the California Railroad Commission, with the assistance of a well-organized advisory committee, is investigating this problem.

Practicability of Electrification

The steam railroads may not be ready to electrify their lines, but the courts have now decided that since electrification may be carried out a certain penalty attaches to failure to employ this means of operation in cities where smoke may be a cause of damage. For more than a generation the courts of Pennsylvania have held that property owners could not recover from a railroad for injury from locomotive smoke. This rule was originally laid down in the case of Philadelphia property owners who sued the Pennsylvania Railroad for alleged damage to property near the Broad Street station. The reasoning of the courts was to the effect that as the lawful operation of a railroad as a public conveyance could not be carried on without a certain amount of smoke, the road could not be penalized for this as an offense against the property rights of others. This rule has now been upset by a decision of the Pennsylvania Supreme Court in a suit against the Reading Railroad alleging damage from smoke along the line of the Reading's new elevation through the city. The court in this case declares that the old rule no longer holds good, for the reason that the perfection of electrical transportation systems provides a means by which the smoke nuisance may be avoided. As a means of accelerating the work of electrifying steam lines no more potent force can be imagined than the threat in this decision that the penalty for steam operation in cities may be an enormous number of damage suits. How the steam roads are to get the money for immediate and wholesale electrification is something with which the court did not concern itself, but it is positive as to the practicability of electrical operation.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Withdrawal of Suit Against the A. I. E. E.

In our issue dated June 14, 1913, a record was made of the denial by Justice Page, of the Supreme Court of the State of New York, of a temporary injunction to restrain the American Institute of Electrical Engineers from making transfers in membership classification in accordance with a special section of the constitution described on page 864 of our issue for April 26, 1913. Mention was made of the fact that the plaintiffs were not debarred from continuing the suit for a permanent injuction. We are now able to state that the plaintiffs have concluded not to carry the matter further and that accordingly the suit has been discontinued.

Although the special section was in force for only a few months and expired in May, 1913, a week or so after the suit was filed, the plaintiffs sought to prevent the Institute and its directors from recognizing as members of the higher grades those who had been transferred thereto under the special section. The directors claimed that for facilitating the changes in grading the special provision for a limited time was necessary, proper and legal. As a result of the suit it can now be said that the board of directors has been fully sustained in its interpretation of the special section of the constitution.

Convention of American Electric Railway Association

The annual convention of the American Electric Railway Association and its affiliated organizations will be held at Young's Pier, Atlantic City, N. J., Oct. 13 to 17 inclusive. The parent body will hold three sessions, at which executive matters of the railway industry will be discussed. Besides the usual committee reports there will be a number of addresses on valuation, the tendency of public utility laws and regulations, relief of city congestion, railway securities from an investment viewpoint, publicity work and welfare work. Some of the most important reports to be presented before the American Association will deal with public relations and joint use of poles. The accountants will hold sessions every day during the convention, as will also the Engineering Association. The claim agents will meet on three days, and the Transportation and Traffic Association will also hold three sessions. Among the papers of special importance to be read at the engineering meetings will be one on power distribution and another on power generation. As usual, the Manufacturers' Association will make a comprehensive exhibit on the pier.

Commonwealth Edison Company Co-operates with Associated Contractors

The Commonwealth Edison Company of Chicago has recently made an arrangement with the Electrical Contractors' Association of the city of Chicago and the Faraday Electrical Association whereby the members of those associations will receive in advance the money on approved contracts for wiring existing buildings or apartment houses to be supplied with central-station energy. In turn, the central-station company will reimburse itself by making arrangements with its customers by which the payment of the bills for electrical work will be spread over a term of two years. Contracts for wiring new buildings or for installing additional equipment in buildings which are already receiving electrical energy will be included.

As the Commonwealth Edison Company has a large construction department of its own, this agreement with the contractors may be looked upon as a result of the co-operative tendency which has been brought about by the Society for Electrical Development. It is asserted by Mr. W. J. Collins, secretary of the Faraday association, that this agreement will be beneficial in smoothing out the annual fluctuations which have existed in the electrical contracting business.

Eleventh Annual Jovian Congress

The eleventh annual Jovian Congress will be held at the Hotel Astor, New York City, Oct. 14-16 inclusive. The congress will be opened on Tuesday morning by an address of welcome by Mayor Kline of New York City, the session being held in the north ballroom of the hotel. Mr. W. E. Robertson, of Buffalo, past Jupiter No. 6, will respond to the Mayor's welcome, and after the appointment of a number of committees the congress will adjourn until the next morning.

The registration of Jovians will begin at 9 o'clock on Tuesday in a room adjoining the north ballroom of the hotel. A badge will be furnished to those who register and this will entitle the bearer to admission to the meetings or entertainment features. A printed list of the registrations will be issued on Wednesday and Thursday mornings.

The business session of the congress will be held on Wednesday morning at 10 o'clock, and matters pertaining to the welfare of the order will be taken up at that time. These will deal in part with changes in the ritual, by-laws and constitution necessitated by the growth of the organization. Immediately following the session a Jovian lunch will be served at Michaud's restaurant, at Forty-second Street and Broadway. On Wednesday afternoon there will be competitive degree team work at the New Grand Central Palace, Forty-sixth Street and Lexington Avenue. Prizes will be given to the team doing the best work as well as to the Jovian who best interprets the part he has taken.

The annual rejuvenation will take place on Wednesday night in the New Grand Central Palace, and it is expected that some 200 men will be initiated. The rejuvenation will be followed by a smoker and supper during which there will be a vaudeville entertainment. The supper, smoker and entertainment will be given by the New York Edison Company, and will be held on the third floor of the Palace.

On Thursday morning a co-operative session will be held at which the following men have been invited to speak: Messrs. Henry L. Doherty, president of the Society for Electrical Development; Charles L. Eidlitz, past-president of the National Electrical Contractors' Association; Lee Galloway, of the New York University School of Commerce, and James H. Collins, commercial writer. The election of officers of the organization will follow immediately after the Thursday morning meeting. On Thursday night the annual banquet will be held in the grand ballroom of the

Hotel Astor. The tickets for the banquet may be purchased at the registration bureau, the cost per plate being $5.

Special entertainment features will be provided on Wednesday and Thursday for visiting ladies. On Wednesday afternoon the ladies will be given tickets for a matinee, and on Wednesday evening there will be a recital at the Hotel Astor given by Edison's newest disk phonograph. On Thursday afternoon an automobile ride will be provided, and on Thursday evening the ladies will be admitted to the balcony of the grand ballroom, where refreshments will be served. Preparations have been made by the New York Jovians to entertain their guests, and committees on entertainment are busily planning so that all visiting Jovians may be assured of an enjoyable time.

The Bases of Reports of Government Ownership of Telegraph and Telephone Lines

Inquiries made at Washington by a representative of the *Electrical World* indicate that the report that the Washington administration is to embark on a policy of government ownership of telephone and telegraph lines is based primarily on an investigation now being made by Congressman David John Lewis, of Maryland, rather than on the present attitude of the administration itself. This investigation is being conducted wholly on the initiative of Congressman Lewis and has reached a point where his conclusions and recommended course of action are nearly ready for announcement.

Up to this time the complex subject of government ownership of telephone or telegraph lines has not been considered by the present administration so that predictions as to future possible action are not justified. So far as it could do so, the administration has been bending its energies toward the passage of the tariff bill, with the support of its party in Congress. Now that this part of its program has been carried out, it will undoubtedly turn a similar close attention to the pending currency bill. When some disposition is made of this measure, other matters will, of course, be taken up, but so far what they will be has not been decided.

If a policy of government ownership of telephone and telegraph lines is urged, it is believed that the exponent of such a doctrine among the President's advisers would be Postmaster-General Burleson. He has a plan in mind to recommend the extension of government activities in this direction, but it is nebulous. Such a plan would probably be submitted first to the President, and in circles in close touch with the administration it is stated that the matter has not been considered in this way. The fact that such a project has not received consideration except perhaps within the Post Office Department is not regarded as conveying any assurance as to the position of the administration either in favor of or against a policy of this nature. It simply has not been considered.

The extension of government service to the telephone and telegraph lines has been recommended by two predecessors of Postmaster-General Burleson. Both Mr. Wanamaker and Mr. Hitchcock, the immediate predecessor of the present incumbent of the office, favored it. The annual report of the Postmaster-General will be prepared and submitted before the close of this year, but it is impossible to ascertain whether or not the indefinite ideas now in mind will take such shape that they will be presented as formal recommendations in this document.

Some color has been given to the reports that the Postmaster-General is interested in the matter by the annoucement that the Alaska military cable and telegraph system will be transferred from the War Department to the Post Office Department. This system comprises a total of 2500 miles of submarine cable, 1200 miles of land service and ten wireless stations. Major Charles McKay Salzman, of the Army Signal Corps, has been transferred to the Post Office Department temporarily in connection with the proposed change in control of this property. The War Department wants to be relieved of its duty with respect to the Alaska lines, pointing out that they are not needed now for purely military purposes. Whether any particular significance with respect to the larger subject of government control of other lines can be attached to this matter cannot be learned in Washington.

The administration and members of Congress who are especially interested in the parcels post system are unquestionably pleased over the large volume of business which this departure has brought to the Post Office Department. When this service was started it was strongly competitive with the business of express companies and subsequent development has made it still more so. The effect of the parcels post system was to make the government a competitor of the express companies to an extent that is disastrous to the revenues of those companies.

The investigation of telephone and telegraph matters which is being conducted by Congressman Lewis has been under way since March of the present year. It is based primarily on available statistical and report data regarding companies engaged in these services, supplemented to some extent by personal research. It is not confined to companies in this country, but has been extended to the systems of other countries; it embraces rates, service, capitalization and other factors of importance. Congressman Lewis has been much interested in the extension of the parcels post system and it was his study of this matter that led him into the analysis of the telephone and telegraph situation. It is not possible to learn just what use will be made of the data accumulated by Congressman Lewis, but they will be embodied in an exhaustive report.

Jovian Records Broken in St. Louis

St. Louis Jovians are having something to say about the remarkable rejuvenation in that city on Oct. 1. It was the greatest in the history of the Jovian order, 259 candidates being initiated. In addition, the local statesman, Mr. F. D. Beardslee, has the distinction of bringing into the organization more new members in one year than any other statesman. The ceremonies were held in the Odeon Building, and Mr. Beardslee was assisted by a number of prominent Jovians, including Messrs. Ell C. Bennett, national Mercury, St. Louis, and George C. Richards, of Chicago, statesman.

Among the candidates who were initiated were Messrs. James E. Allison, formerly of the St. Louis Public Utility Commission; E. R. Kinsey, president of the Board of Public Improvements of St. Louis; C. L. Holman, president of the Laclede Gas Light Company; W. H. Whitton, secretary and treasurer of the Laclede Gas Light Company, and Frank Adam, of the Frank Adam Electric Company. Mayor Kiel of St. Louis had signed an application, but was unable to be present. The degree team, which did its work with the greatest smoothness, was made up as follows: Jupiter, Mr. George E. Cullinan; Hercules, Mr. H. Spoehrer; Vulcan, Mr. John P. Casey; Mercury, Mr. O. E. Hines; Pluto, Mr. Burt Crouch; Avrenim, Mr. A. C. Cornell; Mars, Mr. Lee Rosebrough; Neptune, Mr. P. B. Gilroy; Apollo, Mr. T. T. Richards. In addition there were a large number of "imps" and escorts. Over 500 Jovians and candidates assembled in the Odeon Building at 6:30 p. m., when a buffet luncheon was served. Mr. Thomas H. Bibber, of New York, gave an entertaining monologue, and Mr. Sam A. Hobson, of Chicago, past Jupiter, delivered an address on the history of the Jovian Order. Taken altogether, the rejuvenation and joviation were about the biggest things ever "pulled off" in Jovianism.

Future of Associations

Mr. C. H. B. Chapin, secretary of the Empire State Gas and Electric Association, read a paper at the annual meeting of the association in New York on Oct. 2 in which he recommended radical changes in the association movement in this country.

There is a more or less prevalent opinion among lighting men, Mr. Chapin said, that association work is demanding too much time and is costing too much money. Statements of this kind do not question the value of associations but rather indicate the feeling that there is much useless duplication of effort and waste of time and money.

Associations can very properly be divided into two classes, (a) those composed of individuals and (b) those composed of corporations. The individual joins an association for the purpose of learning, through conference with others engaged in the same or similar line of endeavor, of improvements and advances in the industry, and in order to increase the value of his services either to his employer or to his clients, or he may also have the altruistic purpose of giving to his profession the benefit of his personal experience and thought. Gas and electric corporations are interested in this class of associations because they appreciate that the technical discussions tend toward greater efficiency and because the knowledge obtained by the individual employees redounds to the benefit of the employer.

A corporation joins an association of the second class realizing that there are many matters that can be handled most economically and effectively through co-operation with others, that uniformity of methods and practices is desirable so far as possible, that there is always something useful which may be learned from intercourse with others and that no public service corporation can or will be judged solely on its own merits or demerits, but that such judgment is influenced to a very considerable extent by the merits or demerits of others and that therefore frequent conference is necessary and advisable.

Mr. Chapin added that since the organization of most of the existing associations conditions in the industries in which we are interested have undergone great changes. The effects of these changes have been threefold: First, the two industries, the supplying of gas and the supplying of electricity to the public, which formerly were highly competitive, have been brought into such harmonious relations that they are now commonly referred to merely as two branches of one business; second, the adoption of the policy of regulation by state commissions has emphasized the importance of the state organization as a means for handling questions which, although local to a single state, are general throughout that state; third, the holding companies, with properties in a number of states, make necessary some sort of a clearing house or central organization.

Eliminating all considerations of existing associations and assuming a fresh start together with an entirely clear field, would not the above conditions be met by having a local gas and electric association in each state as the working unit and by then having a National Gas and Electric Association, composed of these state associations and supported by them? This National Gas and Electric Association would be the association of the second class corresponding to the American Engineering Association suggested by Dr. William McClellan in his paper before the American Institute of Electrical Engineers last June.

Mr. Chapin stated that the benefits of the scheme would be as follows: First, each operating company would belong to but one organization; second, the large amount of duplication in work which occurs under the present arrangement would be eliminated; third, the matters of public policy in any state would be in the hands of persons actually operating in that state; fourth, the companies would not be compelled to send their representatives long distances to conventions at large expense; fifth, the meetings would be smaller than is the case with the national conventions and therefore allow for freer discussion and greater informality than obtain in these gatherings.

Wilson-Simmons-Underwood Tariff Bill

The new tariff bill was signed on Oct. 3 by President Wilson and became law. As a whole, a decided reduction in rates has been made, particularly on foodstuffs, fabrics and items of large consumption and general use. In the tabulation following appear the comparative rates under the old and the new law on some of the items of interest to the electrical industry.

COMPARATIVE TARIFF RATES

Items	Old	New
Acids:		
Sulphuric	¼c. per lb.	Free
Hydrochloric	Free	Free
Nitric	Free	Free
Calcium carbide	25%	Free
Magnesia, calcined	7c. per lb.	3½c. per lb.
Paints, enamels, colors, stains, frostings, ceramic and glass fluxes, glazes	30%	15%
Mica:		
Unmanufactured, valued at 15 cents per lb. or under	5c. per lb. & 20%	4c. per lb.
	5c. per lb. & 20%	25%
Valued above 15 cents per lb.	10c. per lb. & 20%	30%
Cut or mica splittings, built-up mica. Manufactures of, wholly or in chief value	10c. per lb. & 20%	30%
Ground	20%	15%
China and porcelain wares, not decorated	55%	50%
Carbon:		
Electrodes for electric furnaces and batteries, brushes	30%	25%
Gas retorts	20%	10%
For electric lighting, made entirely from petroleum coke	35c. per 100 ft.	15c. per 100 ft.
For electric lighting, made chiefly from lampblack or retort carbon	65c. per 100 ft.	40c. per 100 ft.
For flaming-arc lamps	35c. per 100 ft.	30%
Pots for electric batteries	20%	15%
Glass:		
Incandescent electric light bulbs or lamps with or without filaments	60%	30%
Steel Alloys:		
Titanium, tantalum and tungsten metal valued at $200 per ton or less	25%	15%
Valued at over $200 per ton	20%	15%
Iron or Steel Sheets:		
Valued at 3 cents per lb. or under	5-10c. per lb.	12%
Valued at over 3 cents per lb	30%	12%
Or other metal ball or roller bearings	45%	35%
Railway fish-plates or splice bars	3-10c. per lb.	10%
Sheets or strips coated or galvanized —additional	2-10c. per lb.	10%
Sheets or plates with layers of copper, nickel or other metal imposed thereon	40%	15%
Wires:		
Telegraph, telephone and other wires and cables of metal and rubber	40%	20%
Galvanized or coated with metal— additional	2-10c. per lb.	20%
Not otherwise provided for	45%	20%
Aluminum:		
Scrap alloys	7c. per lb.	2c. per lb.
In strips	45%	3½c. per lb.
Plates, sheets, bars, rods	11c. per lb.	3½c. per lb.
German silver	25%	15%
Copper:		
In rolled plates, sheets, rods, strips, pipes and bottoms	2½c. per lb.	5%
Sheathing or yellow metal	2c. per lb.	5%
Nickel alloy pigs, bars, ingots, rods or plates	6c. per lb.	10%
Sheets or strips	35%	20%
Quicksilver	7c. per lb.	10%
Steam engines and machine tools	30%	15%
Railroad ties, telephone, trolley, electric-light and telegraph poles of cedar or other wood	10%	10%
Indurated fiber ware not provided for	35%	25%
Manufactures of amber, asbestos or wax not provided for	25%	10%
Asbestos yarn	25%	20%
Woven fabrics	40%	20%
Unmanufactured	Free	Free
Manufactures of India rubber or gutta percha	35%	10%
Crude	Free	Free
Manufactures of hard rubber not provided for	35%	25%
Crude bauxite	$1 per ton	Free
Beeswax	Free	Free
Coal:		
Anthracite	Free	Free
Bituminous and shale	45c. per ton	Free
Culm and slack	15c. per ton	Free
Composition for fuel	20%	Free
Unmanufactured lava	Free	Free
Manganese ore and oxide	Free	Free
Life-saving apparatus	Free	Free
Models of inventions	Free	Free
Philosophical and scientific apparatus for experimental purposes only	Free	Free

Society for Electrical Development Activities

The Society for Electrical Development will issue shortly a list of its members as of Oct. 1, 1913. The list will be published in pocket-size booklet form and will be mailed to members of the society, who now number over 600. Only partial returns have been received by the society from the Jovian campaign for membership. None of the forty-five Jovian leagues has reported to Jovian headquarters, as they are expecting to make their final returns at the close of the campaign on Oct. 31. The membership campaign committee, of which Mr. W. E. Robertson, of Buffalo, N. Y., is chairman, has decided to call the last week in October "pioneer member week," and every effort is being made by this committee as well as the Jovians to secure the largest possible number of members during that time.

Proposed Training School for Electric-Vehicle Operators

At the weekly luncheon of the Chicago Section of the Electric Vehicle Association of America on Sept. 30 there was a general discussion of the proposal of Mr. George Harvey Jones, former chairman of the section, that there be established a training school for operators and handlers of electric vehicles. It is felt that a good working knowledge of the construction and operation of electric passenger cars and trucks by drivers, chauffeurs, garage owners and attendants would be of great benefit, not only to owners of vehicles but to manufacturers as well, for many times a car obtains a bad name when the trouble is entirely due to neglect of the battery or some other operating cause. The American Express Company now operates a private school of this sort on a small scale in Chicago, and the Chicago Central Station Institute operates a school for the commercial training of electrical men. It is felt that possibly by taking advantage of these existing agencies to some extent a distinct electric-vehicle training school can be built up in Chicago that will be of very great practical advantage. Chairman Niesz appointed as the educational committee to have charge of this project Messrs. George H. Jones, Commonwealth Edison Company; Ernest Lunn, Walker Vehicle Company; William C. Little, Borland-Grannis Company; C. B. Frayer, Edison Storage Battery Company; G. H. Atkin, Electric Storage Battery Company; D. C. Arlington, Philadelphia Storage Battery Company, and Harry Salvat, Fashion Garage.

Electric-Rate Discussion in Chicago

Meetings of the Chicago City Council committee on gas, oil and electric light, which is considering the proposed reduction of rates of the Commonwealth Edison Company, were resumed on Oct. 2. Mr. Edward W. Bemis, public-utility expert, had been asked to confer with Mr. Ray Palmer, the city electrician, in relation to preparing a report supplementary to Mr. Palmer's report on the Commonwealth Edison Company of last May. In a letter to Mr. Palmer which was read, Mr. Bemis discussed briefly the subjects of going value and depreciation. In relation to going value Mr. Bemis advised that a number of items allowed in the Palmer report be rejected. These related to the proportion of the purchase price paid by the Chicago Edison Company and the Commonwealth Electric Company for the good-will and business of acquired properties, which amounted to about $3,000,000. Mr. Bemis also held that free wiring should not be capitalized for rate-making purposes. In relation to depreciation he approved the annual allowance for depreciation made in the Palmer report—about $2,000,000—but he objected to an item of about $3,600,000 listed in the Byllesby appraisal of 1908 as accrued depreciation.

Commenting on Mr. Bemis' letter, Mr. Palmer said that in making valuations on the original-cost basis going value is a proper charge. The acquirement of properties with their "intangible values" is a legitimate charge with the end in view of reducing rates. The speaker pointed out that the Sanitary District of Chicago, a municipal corporation, has made an allowance for going value in its negotiations with the city of Chicago in the matter of fixing rates for electrical energy used for street lighting. In these negotiations the Sanitary District asked, and was allowed, 21 per cent of its net total physical valuation for going value. The city electrician also contended that it was fair to allow the Byllesby accrued depreciation. He urged the committee to adopt his report and said that a saving to customers of about $636,000 a year could be effected thereby. The committee would do well, he thought, to arrive at some conclusion with the company, if possible, before the State Public Utilities Commission of Illinois comes into existence on Jan. 1 next. He pointed out that if the company refused to accept the City Council's proposal the subject would no doubt go before the state commission, when constituted, anyway.

Colorado Electric Light, Power and Railway Association at Glenwood Springs

The eleventh annual convention of the Colorado Electric Light, Power and Railway Association was held at the Hotel Colorado in Glenwood Springs, Col., Sept. 25 to 27 inclusive. As planned originally the convention and an electric show to be given under the auspices of the Colorado Electric Club were to be held jointly in Denver during the week commencing Oct. 6. Owing to industrial conditions it was decided at a preliminary executive meeting to hold the convention earlier, and because of the recent Knights Templar Conclave in Denver the electric show has been postponed indefinitely.

Delegates from Denver and vicinity were conveyed to Glenwood Springs in four special cars attached to a regular Denver & Rio Grande train leaving Denver on the evening preceding the convention. Other members were picked up at stations en route. The morning of Sept. 25 was spent in visiting the sulphur baths and in excursions to places in the vicinity of Eagle Canon. The convention began on Thursday afternoon with a few remarks from President W. N. Clark, of Canon City. Following him, Mr. W. H. Bullock, of Denver, read a paper entitled "Industrial Motor Appliances." Mr. Artemus E. Ward, of Boulder, described a "cash register system" and went into details on methods of accounting. An interesting demonstration of the "lung-motor" given by Mr. E. S. Tyler, of Chicago, terminated the first session.

Friday morning's session was very short, only two papers being read. Mr. B. C. J. Wheatlake, of Denver, read the first paper, which was entitled "Lightning Arresters." Although the paper had been read before another association, considerable discussion followed. Mr. Charles Neely, of Cripple Creek, read a short paper on "Joint Pole Usage," but his remarks were limited chiefly to lightning arresters. Following the morning session the members enjoyed a swim in the natural hot-sulphur spring.

Mr. R. E. Campbell, of Cleveland, Ohio, delivered the first paper of the afternoon session. His topic was on "The Relation of the Incandescent Lamp to Lighting Service." Other papers were read as follows: "The Central Station in the Small Town," by Mr. H. L. Titus, of Sterling; "The Use of Single-Phase Motors from the Central Station Standpoint," by Mr. W. A. Layman, of St. Louis, Mo. (read by Mr. O. H. Davidson, of Denver), and "The Central Station Off Peak—Its Remedy," by Dr. Melcher Eckstromer, of Denver.

On Friday evening a banquet was held in the hotel, at which about sixty-five were present. Mr. R. L. Holland, of Colorado Springs, acted as toastmaster.

The first part of Saturday morning's session was devoted to answering questions which had been contributed to the Question Box. Mr. H. S. Russell, of Denver, had charge of this discussion. About fifty-six questions were discussed relating to power plant operation, lines and transformers, wiring and lamps, meters, commercial problems, management and miscellaneous subjects. Mr. D. L. Webb, of Denver, and Mr. R. L. Holland spoke on "Public Utility Bills" and "Tax Commissions" respectively.

Reports of committees followed. The committee considering the question of affiliation with the National Electric Light Association reported that such a step was inadvisable at this time. The committee, of which Mr. W. C. Sterne, of Denver, is chairman, was continued with instructions to investigate the subject further.

A committee was also appointed, with Mr. W. G. Matthews, of Denver, as chairman, to report on the Dostal drop-out for foreign wire crossings in comparison with other methods.

Mr. John J. Cooper, of Denver, chairman, submitted the recommendations of the nominating committee, which were accepted. The following officers were elected:

Mr. W. C. Sterne, vice-president and general manager of the Summit County Power Company, Denver, president;

PRESIDENT-ELECT W. C. STERNE

Mr. W. F. Raber, general manager of the Arkansas Valley Railway, Light & Power Company, Pueblo, vice-president; Mr. T. F. Kennedy, superintendent of sales of the Denver Gas & Electric Light Company, secretary-treasurer. The executive committee comprises Messrs. W. J. Barker, general superintendent of the Denver Gas & Electric Light Company; H. U. Wallace, general manager of the Northern Colorado Power Company, Boulder; L. P. Hammond, general manager of the Colorado Power Company, Denver; W. F. Raber and W. C. Sterne.

Mr. W. C. Sterne, the newly elected president of the Colorado Electric Light, Power and Railway Association, was born in Peru, Ind., in 1869. Following his graduation from Harvard in 1891, Mr. Sterne went abroad in the capacity of newspaper and magazine correspondent. He returned to this country and settled on a ranch in Littleton, Col. For the last ten years Mr. Sterne has been connected with the electrical business either as financier or as an executive head. Until 1909 he was located in Littleton, but since then he has lived in Denver. While in Littleton Mr. Sterne financed the building of the Arapahoe Electric Light & Power Company. Mr. Sterne is president and general manager of this company and is vice-president and general manager of the Summit County Power Company, which is a Doherty property. In addition to these positions he holds the following offices: president and general manager of the Arvada Electric Company, supplying a portion of Jefferson County, president and general manager of the Fort Lupton Light & Power Company, vice-president and general manager of the McCook (Neb.) Electric Company, and president and general manager of the Municipal Properties Investment Company, which is the holding company of all the Colorado companies mentioned with the exception of the Summit County company. During the years 1905-06 Mr. Sterne was president and general manager of the Laramie (Wyo.) Light & Power Company.

Convention of Atlantic Gas & Electric Company

The first annual convention of officers, managers and employees of the Atlantic Gas & Electric Company, which owns and operates a number of public utilities in the East, was held at the Waldorf-Astoria, New York City, Oct. 2. The morning session was given over to the operating and commercial men, while in the afternoon broad policies of utility management were discussed by bankers, attorneys and accountants connected with the associated companies.

Mr. A. D. Lord, president of the Atlantic Gas & Electric Company, opened the convention with a brief address, after which short papers were presented by Messrs. C. M. Pihl, Eastern Pennsylvania Power Company, Easton, Pa., on "Co-operation Toward Better Relations with and Increased Efficiency of Employees"; R. W. Kiple, vice-president of the Gas and Electric Demonstrator, the Atlantic company's publicity subsidiary, "Merchandising Gas and Electric Appliances"; S. H. Dailey, vice-president and general manager Binghamton (N. Y.) Light, Heat & Power Company, "Power Extensions"; W. B. Ross, Binghamton, N. Y., "Industrial Power"; C. W. Lee, New York, "Points of Contact with the Public"; H. W. Brunell, Gas and Electric Demonstrator, "Power-Factor and Load-Factor"; T. M. R. Meikleham, Meikleham & Dinsmore, New York, "Loyalty"; F. S. Nicholson, Sayre (Pa.) Electric Company, "Problems in Developing the Small Scattered Territory"; E. J. Hutter, mechanical engineer Atlantic Gas & Electric Company, "The Engineering Department"; G. B. Cornell, chief engineer Atlantic Gas & Electric Company, "Water-Powers"; Louis Saxon, electrical engineer Atlantic Gas & Electric Company, "Electrical Systems of Generation and Distribution"; W. H. Yeomans, manager steam-heating department Eastern Pennsylvania Power Company, "Steam Heating." An address by Mr. Frank M. Tait, Dayton, Ohio, was expected, but in Mr. Tait's absence Mr. Daniel M. Lord, formerly head of the Lord & Thomas advertising agency, gave a brief, enthusiastic talk on advertising. A buffet luncheon was served to the members and guests in one of the convention rooms.

At the afternoon meeting papers and talks were given by Messrs. Edgerton Parsons, Mather & Company, insurance brokers, New York, on "Public Utility Insurance"; J. B. Livingston, Detroit Trust Company, "Interdependency of Operators and Financial Managers"; T. C. Perkins, T. C. Perkins, Inc., Hartford, Conn., "Organization Features of the Atlantic Gas & Electric Company"; F. V. Shannon, treasurer of the Atlantic Gas & Electric Company, "The Accountant in Public Service Corporations"; O. H. Oxford, auditor Atlantic Gas & Electric Company, "Auditing Gas and Electric Acounts"; N. W. Fox, attorney, Easton, Pa., "Courteous Treatment of the Public"; F. C. Culver, counsel Atlantic Gas & Electric Company; Theodore Beran, General Electric Company, "Address to the Young Men"; W. A. Meikleham, "My Connections with the Atlantic Gas & Electric Company"; C. A. Paul, Meikleham & Dinsmore, "The Philadelphia Investor"; F. W. Low, engineer of construc-

tion Atlantic Gas & Electric Company, "Plant Conditions," and J. S. Eaton, broker, "The Need of Correct Public Policy." At the close of the meeting Mr. G. S. Rose, of the General Electric Company, explained the principles of operation of the new nitrogen-filled "high-efficiency" incandescent lamp and exhibited a 1000-watt unit.

In the evening a banquet was given in the Myrtle Room of the Waldorf-Astoria for the directors, officers, managers, engineers and guests of the association.

High-Voltage Direct-Current Locomotives for Canadian Northern Railway

As the eastern end of the Canadian Northern Railway, the new transcontinental line now being built, Montreal will have the distinction of being the first city in which the railway terminal was electrified when initially opened for service. There will be 10 miles of double track, though the Mount Royal Tunnel between the passenger and freight terminals in the city of Montreal and the Cartierville yards, where the trains will change from steam to electric locomotives.

An order has been placed with the General Electric Company for seven locomotives, eight multiple-unit motor-car equipments and complete substation apparatus. Direct-current energy will be furnished to the locomotives and cars at 2400 volts. The motors will be commutating-pole machines insulated for 2400 volts, but will be operated two in permanent series with 1200 volts across each motor. Each locomotive will weigh 80 tons and will be equipped with two four-wheel trucks articulated together with four motors geared to the drivers through twin gears.

Energy for operating the locomotives and motor cars will be purchased in three-phase, 60-cycle, 11,000 volt-form. It will be transformed to 2400-volt direct-current energy by means of motor-generator sets, each of which will consist of a 2100-kva, 11,000-volt synchronous motor driving two 750-kw, 1200-volt commutating-pole generators connected in series. At first there will be two sets, but later a third will be added, bringing the rating up to 4500 kw.

Mr. W. C. Lancaster, electrical and mechanical engineer on the Montreal tunnel and terminal construction for MacKenzie, Mann & Company, Ltd., is in charge of both the design and installation of the electrical equipment.

Meeting of the Empire State Association

The Empire State Gas & Electric Association had an interesting and varied program at its ninth annual convention, held in the Engineering Societies Building, New York, Oct. 2. The association makes it a practice to hold its annual meetings in New York City and most of its other sessions at various points throughout the State. A new feature which contributed greatly to the success of this meeting was the participation of Mr. Martin S. Decker, chairman of the New York Public Service Commission, Second District, and Mr. Milo R. Maltbie, member of the First District commission, who spoke on public service questions.

After the opening formalities, the annual address of the president was read by Mr. C. G. M. Thomas, who reviewed carefully the work of the year in all directions.

Among the matters which received the attention of the executive committee during the year was an article in an important New York City daily paper stating that food, fuel and lighting all cost more than at any other time within the last thirty years. The article originated in the Bureau of Labor Statistics at Washington. The executive committee instructed the secretary of the association to protest against the statement that lighting cost more. The Bureau of Labor Statistics replied that "lighting" referred to candles and matches and courteously agreed to change the heading of future articles.

During the coming session of the Legislature undoubtedly further attempts will be made to establish districts within which political bodies of some kind may generate electric energy employing the so-called surplus water-power owned by the State. This matter must have careful and continuous attention by the association, and members cannot serve their interests better than by supporting the work of the committee in charge of this subject through suggestions to the executive committee.

Mr. Thomas added that compulsory liability and state insurance is a live issue. No industry does more for the care of its injured employees than the lighting industry. The cordial relations now existing between the companies and their employees arouse jealousy in the labor agitator who would supplant voluntary care with compulsory liability, though the latter provides less compensation to the injured and, by taking the process of settlement away from the members and giving it to a politically appointed commission, would end personal relations between the company and its men.

Mr. Thomas further suggested the need for earnest constructive work in outlining employment for the so-called surplus waters of the State in other channels than the generation of electric energy and its sale to the public by the State. It had been suggested that the storage of water for the prevention of floods and its use for irrigation would be much more profitable for the entire State than destructive competition with an important industry. The appointment of a committee on safety was recommended by Mr. Thomas.

Mr. Stuart Wilder, Westchester Lighting Company, presented his report as treasurer. Mr. C. H. B. Chapin, secretary, made his report.

Meter Committee

Mr. C. G. Durfee, Rochester Railway & Light Company, chairman of the committee on electric meters, read the report of this committee, the other members of which are Messrs. S. G. Rhodes and L. Heaton.

The committee has been in touch with the meter committees of the Association of Edison Illuminating Companies and the National Electric Light Association and has confined its activities to keeping informed as to the development of the meter art, especially with reference to the development by various manufacturers of lower-priced watt-hour meters and maximum-demand meters.

The committee said in regard to the order on meters issued by the Public Service Commission, Second District, on July 3, 1913:

"It would appear to the committee as if the order merely contemplated the retirement of certain old and undesirable types of meters which may still be in use in certain parts of the State. The first part of the order, for instance, specifies the removal of commutator types of meters from alternating-current circuits. The committee feels that no member-company would object to this policy of retiring this type of meter from such use.

"The second part of the order, however, while probably drawn with the intention of retiring other old types, namely, the ampere-hour meters, has been so worded as entirely to prohibit the present or future use of any types of ampere-hour meters for either alternating-current or direct-current service. The order, therefore, plainly blocks or discourages the development of a type of meter which is very widely used and approved abroad and which is considered a most favorable line of development by the American manufacturers. We do not feel that it was the intention of the commission thus to discourage future development."

At the suggestion of the committee, it was decided that

the matter should be brought to the attention of the commission.

Mr. James T. Hutchings, chairman of the committee on electric vehicles, made a verbal report, recommending that steps be taken to provide for the charging of electric pleasure vehicles at certain points where facilities are not furnished now so as to promote trips between New York and Buffalo. He said that route maps should be prepared showing several routes between New York and Buffalo and side trips. He believed that much interest could be aroused in these trips.

Mr. Arthur Williams made a verbal report for the conservation committee, outlining the work done during last year.

Mr. A. D. Dudley, Syracuse, called attention to the advertising campaign proposed by the National Commercial Gas Association. This was described at length by Mr. T. R. Elcock, United Gas Improvement Company. The association indorsed the plan and referred it to the executive committee for action.

Mr. J. M. Wakeman presented the plans of the Society for Electrical Development. He said that it was not intended to interfere with the plan for gas development. Many members of the society are interested in both forms of service. The society now has a list of more than 600 members fairly well distributed between the different branches of the industry. The plan of the society was approved by the association.

Invitations were received from the Consolidated Gas Company and the New York Edison Company to visit the showrooms of those companies.

The association then adjourned for lunch, which was served at the Engineers' Club. At the conclusion of the lunch President Thomas expressed the appreciation of the members of the presence of Chairman Decker of the Second District commission and Commissioner Maltbie of the First District commission.

Talks by Public Service Commissioners

Mr. Decker spoke on "Public Service by Private Corporations." He said that while the companies generally have no active competition in their communities, the potential competition under the existing form of government is a restraining influence that is bound to have effect. He said that the public service commissioners are interested in the welfare of the companies furnishing public utility service as well as in the welfare of those who buy that service.

The public service corporations, Mr. Decker said, should popularize their service. There is no reason why electricity should not be used to operate the sewing machine and other articles in the home. The most common use of public utility service at the most reasonable price would conserve the revenues of the companies. There should be saturation by service of the greatest possible public demand.

Mr. Maltbie, speaking on "The Advantages of Public Utilities," told his hearers that they are supplying what have come to be practically necessities of life. He referred to the interruption of subway and other transportation service last week as a result of the heavy rainstorm and said that it had given everyone a realization of what would happen to the whole scheme of public welfare if a similar interruption occurred to other forms of public service. If the telephone should be discontinued, the electric and gas lights should go out and there should be no transportation service for a few days, a condition of chaos would result.

The fact that corporations have such close relations with the public means, Mr. Maltbie said, that this advantage is offset by the responsibilities they assume. In the last seven years in New York State the feeling of suspicion on the part of the general public that the corporations have something to conceal has been decreased by the willingness of the corporations to show the facts. Mr. Maltbie told his audience that the principal thing to be gained is the confidence of the public. There should be a feeling on the part of the public that it can rely on the statements of the corporations and a feeling on the part of the corporations that they will get fair treatment from the public.

Accident Prevention

At the afternoon session, Mr. James B. Douglas, United Gas Improvement Company, gave an illustrated talk on accident prevention.

Mr. Victor T. Noonan, secretary of the general safety committee of the Rochester Railway & Light Company, said that this company has, in addition to its general safety committee, twenty-eight sub-committees composed of engineers, foremen and employees. The best results in the reduction of accidents have been obtained from educational methods. Every endeavor is made to get the co-operation of the men. The problem of getting close to the men is solved if their interest is aroused and they learn that the heads of departments are concerned in their welfare.

Mr. W. P. Strickland, general inspector of the New York & Queens Electric Light & Power Company, also spoke on this subject.

Accident prevention was discussed by Messrs. R. M. Searle and J. T. Hutchings, of Rochester; Mr. James O. Carr, of Schenectady, and Mr. F. B. H. Paine, of New York. Mr. Searle suggested that one man be hired to do nothing but take out and bend down nails on boards. Mr. Paine said that the companies should inspect their men as well as their materials and should assume the responsibility for correcting the men.

Fire Prevention

Mr. Bruce E. Loomis, Marsh & McLennan, New York, read a paper on "Fire Prevention." He said that slowly but surely the fire insurance companies have come to the conclusion that gas and electric properties are not such serious hazards as was generally thought a few years ago. Rather discouraging experiences for a number of years led to a special study of these classes and careful inspection of the circumstances in each fire.

A digest of the causes of 100 fires in power houses was shown, which emphasized the mistake of building these properties of anything but non-combustible materials. Lightning in transformer houses appears to be more of a hazard than in other buildings.

The use of non-combustible boiler-house construction and the replacing of wood floor with concrete were suggested by Mr. Loomis as preventive measures.

Mr. Loomis said he was firmly convinced that by careful inspection and the carrying out of improvements, often very simple, any rate could be secured that a company is willing to pay irrespective of the construction of the properties. The insurance companies make hard and fast rules, yet in many instances something "just as good" can be substituted and sometimes the rate can be cut in two.

Mr. C. H. B. Chapin, secretary of the association, read a paper on the "Future of Association Work," an abstract of which is published elsewhere in this issue.

President Thomas said that Mr. Chapin's paper was presented with the approval of the executive committee and that the ideas which it contained should receive careful consideration.

Mr. F. C. Bates, General Electric Company, displayed two lamps, one an old-style 500-cp lamp and the other a 1000-cp nitrogen-filled lamp.

The election of officers resulted as follows: President, Mr. James T. Hutchings, Rochester; first vice-president, Mr. J. C. De Long, Syracuse; second vice-president, Mr. E. H. Palmer, Auburn; treasurer, Mr. Stuart Wilder, Mount Vernon; secretary, Mr. C. H. B. Chapin, New York; executive committee, Mr. C. G. M. Thomas, Long Island City; Mr. C. A. Graves, Walton, and Mr. H. M. Beugler, Poughkeepsie.

Alexanderson Single-Phase Locomotives

The adoption by the Norfolk & Western Railway Company of the split-phase type of locomotive for the Bluefield (W. Va.) section of its main line, as described on page 268 of our issue dated Aug. 9 and on page 367 of the issue for Aug. 23, directs attention anew to the subject of phase converters. The split-phase locomotive equipment comprises a number of polyphase induction motors which are inherently of the constant-speed type, a phase converter, and any system of control of the motors which would be used in a polyphase system. The only features added are the phase converter and its controller, a very simple piece of apparatus.

On page 221 of our issue of July 22, 1911, there was given an outline of a method for operating polyphase motors from single-phase circuits described by Mr. E. F. W. Alexanderson in a paper before the American Institute of Electrical Engineers. In this paper the author discussed the theory of the phase converter and reported the results of experiments which indicated the correctness of his theory. Even with the 25-kw equipment employed in the tests the efficiency of conversion was nearly 90 per cent, although the power-factor was low. The experiments, however, were so satisfactory that preparations were made immediately for carrying them out on a larger scale and in heavy electric traction work.

PRINCIPLES OF THE PHASE CONVERTER

Any polyphase motor can be operated as a single-phase motor by connecting one phase to the line and giving the

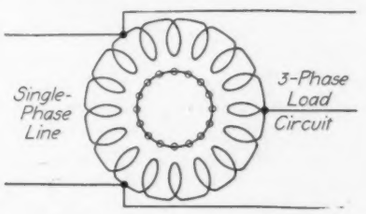


FIG. 1—SHUNT-CONNECTED PHASE CONVERTER

motor a start. The latter will then run at a speed somewhat less than its polyphase speed, and at no load its speed will be practically synchronous. From all of the primary windings, including these not connected to the line, polyphase current can be taken off. (See Fig. 1.) In this case the alternating flux produced by the line current is cut by the conductors of the rotating secondary, which may be either squirrel-cage or phase-wound. The resulting secondary current in turn produces a magnetizing force out of phase both in time and in space with the flux which produced it, and having such a direction that, when combined with the first flux, a rotating field is produced. This rotating field cuts the primary windings not connected to the line and generates emf in them. Thus in a simple manner is produced a converter for changing single into polyphase current.

When no current is drawn in the three-phase circuit the phase voltages are equal and balanced in phase position. When the three-phase circuit is loaded the simple converter described is not commercially satisfactory, as the phase voltages are badly unbalanced.

As developed by Mr. Alexanderson for the General Electric Company, the line phase of the converter is connected in series with one phase of the motor and the second phase of the converter is in series with the other phase of the motor. This arrangement reduces the phase displacement between emfs. By means of an autotransformer, or (as shown in Fig. 2) extra turns on the secondary of the main transformer, a part of the line emf is introduced into the second phase to correct for phase displacement and reduction of the induced emf. An exciting winding is placed on the rotor of the converter in addition to the squirrel cage and is furnished with synchronous exciting current from a small exciter. This permits the elimination of the exciting current from the main windings and greatly improves the power-factor.

Referring to Fig. 2, it will be noted that the trolley voltage is reduced by means of a transformer. This will in

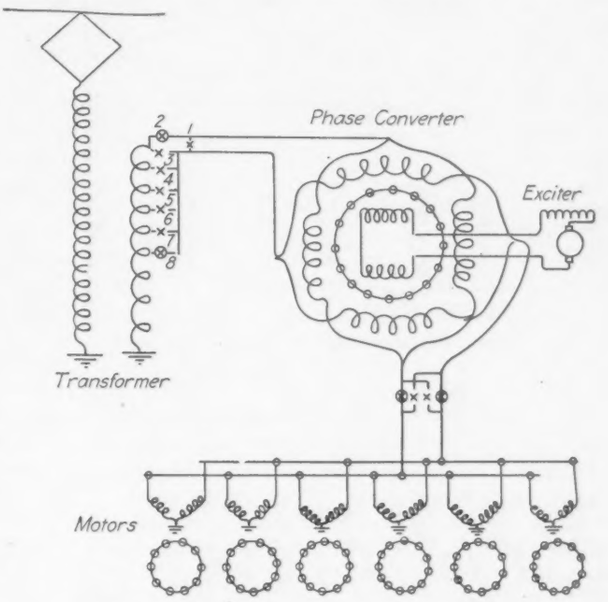


FIG. 2—SERIES-CONNECTED PHASE CONVERTER

general be necessary, as it will not be economical to insulate motors for the line potentials which will usually be employed—that is, 10,000 volts or more. The secondary of the transformer is provided with numerous taps for the purpose of varying the applied voltage, and thus the motor speed, and for supplying the compensating voltage in the second phase. The motors are connected permanently in parellel with a reversing switch in the leads connecting them with the converter.

The operation of the converter will be clearer after a study of Fig. 3, which is a vector diagram of voltages and currents in the circuits shown diagrammatically in Fig 4.

EMF RELATIONS

In Fig. 3 the horizontal line OO' represents the line volts, V_l. This voltage is consumed in the converter

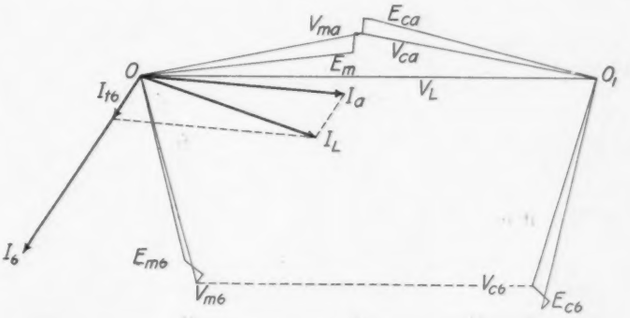


FIG. 3—VECTOR DIAGRAM BASED ON CIRCUITS OF FIG. 4

counter-emf E_{ca} (Fig. 3), in the motor emf E_m, and in the impedance drops in converter and motor.

By induction an emf E_{cb} is generated in the second phase of the converter in time quadrature with E_{ca} because the windings are in space quadrature. A part of the line voltage, V_{tb}, is introduced into phase b and the vector sum of it and E_{cb} is delivered to phase b of the

motor. This is denominated V_{mb}. By the addition of V_{tb} it is brought into practical quadrature and equality with V_{ma} as desired. Finally a part of V_{mb} is used in overcoming the motor impedance, leaving as the motor counter-emf E_{mb}.

Current Relations

By the connection of the phase-*a* windings of the con-

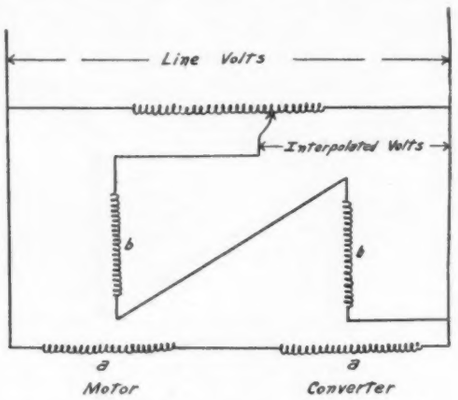
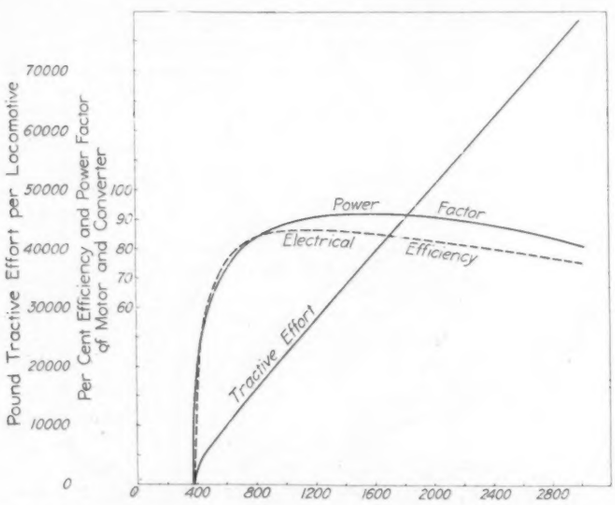


FIG. 4—TWO-PHASE CONVERTER CIRCUITS

verter and motor in series, the former becomes a series transformer the secondary of which produces a current practically equal to, and in time quadrature with, the primary current. This kind of a series transformer differs from the stationary type only in this quadrature relation of the currents. The quadrature relation, as already suggested, is due to the production of the secondary current by the motion of the secondary conductors through the primary flux. The flux is approximately in time quadrature with the primary current, and the secondary current is in time phase with the flux, being produced by motion through it.

Referring then to Fig. 3, it will be noted that a current *Ia* is drawn through phase *a*, its value and phase position depending upon the load and the impedance of the circuit. There is also drawn through the auto-transformer



FAG. 5—PERFORMANCE AT VARIOUS KVA INPUTS TO CONVERTER AND MOTORS

a current, I_{tb}, due to the connection of part of its turns in phase *b*. Its relation to I_b, the current in phase *b*, is determined by the proportion of turns included in phase *b*. The line current is the vector sum of *Ia* and I_{tb}.

The current in phase *b*, being the secondary current in a series transformer, is proportional to the primary current, and with the same number of turns in each winding the two should be equal. Moreover, as explained, they should be in time quadrature in this case and would be so but for the presence of impedance and magnetizing current.

The effect of impedance can be eliminated by the auto-transformer voltage. The synchronous excitation eliminates the latter, the theory being as follows: In an ordinary stationary transformer the primary and secondary currents cannot be exactly equal and opposite or there would be no magnetization of the core. The phase displacement is therefore just enough less than 180 deg. to produce a resultant sufficient to set up the required flux. In a two-phase converter the same argument applies to the quadrature relation. With equal currents in quadrature there would be no magnetizing current. The phase displacement then automatically adjusts itself to some value less than 90 deg. to produce the required magnetizing component. In the case of the stationary transformer, if an extra winding carrying time quadrature magnetizing current were introduced the phase displacement could be given the ideal value of 180 deg., or if the extra current were increased above the necessary value the phase displacement would be more than 180 deg. Obviously, the flux could not be

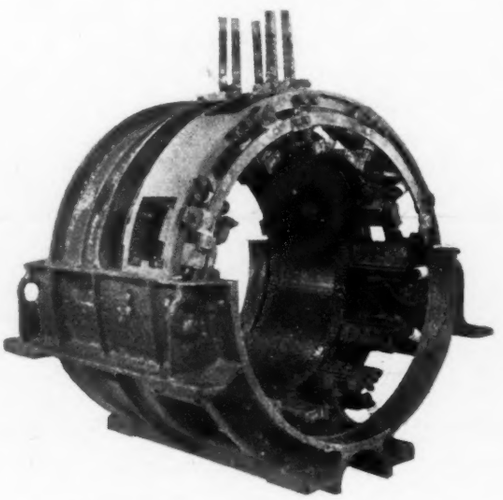


FIG. 6—REPULSION SERIES LOCOMOTIVE MOTOR

increased or the counter emf would be greater than the applied emf. The primary and secondary currents must, then, automatically produce a demagnetizing component to keep the flux at its proper value. In the phase converter an extra winding on the secondary produces any desired phase displacement between I_a and I_b, which would be in time quadrature with exact neutralization of magnetizing component. In Fig. 3, I_{ct} represents the extra component in quadrature with the theoretical position of I_b; that is, exact neutralization of magnetizing component.

A study of Fig. 3 shows that the result of all of the three corrective devices is to produce a good phase balance and a high power-factor.

Split-Phase Locomotive

As stated before, the General Electric Company some two years ago constructed a locomotive to test the phase converter on a larger scale. An experimental locomotive was equipped with a 200-hp motor arranged as a phase converter. This had a squirrel-cage rotor and was tested with and without an exciting winding.

One axle of this locomotive was equipped with a motor of about 250-hp rating, having a temporary steel cylindrical rotor containing no winding. While this was a makeshift, the skin effect in the steel at starting, when the secondary current has line frequency, undoubtedly was of great assistance in producing good starting torque.

With this crude locomotive a number of satisfactory tests were made under very severe conditions. It was accelerated while the trolley contact was frequently interrupted, without any evil effect. As the phase converter runs light, it loses little speed when the supply current is interrupted even for a half minute or so. Its rotor momentum is considerable, and there is no resistance except friction and windage, the excitation failing with the power supply. A still more severe test was the application of full trolley voltage with the locomotive at standstill, the converter running at greatly reduced speed and with the controller at full-speed position. Under these extraordinary circumstances the converter accelerated rapidly and the motor developed sufficient torque to slip the wheels. As a climax the trolley was lowered for a minute with the locomotive at full speed forward, the controller was set for reverse and the trolley returned to position. The motor promptly developed full torque in a reverse direction, slipping the wheels as before.

These tests were so satisfactory that the company proceeded to develop a 1600-hp converter and designed a locomotive now under construction having six motors of 300-hp each intended to produce a 45,000-lb. tractive effort at 15 miles per hour, and one of 30,000 lb. at 22 miles per hour.

On the basis of experimental data now in hand the company's engineers have been able to compute the characteristics of the new equipment as given in Fig. 5. The efficiency and power-factor are both high and remain so over a wide range of output.

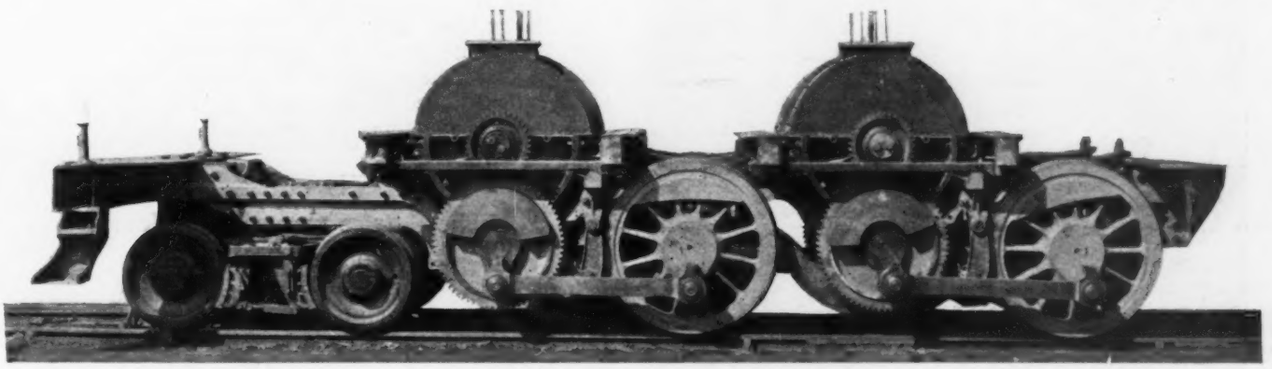


FIG. 7—DRIVING AND PONY TRUCKS OF ARTICULATED REPULSION-SERIES LOCOMOTIVE

The Repulsion-Series Locomotive

A promising development in single-phase traction equipment was described in an article on page 144 of our issue dated Jan. 18, 1908, based on a paper presented by Mr. Alexanderson before the American Institute of Electrical Engineers. The motor was of the so-called series-repulsion type, with which Mr. Alexanderson's name has been associated for the past five years. As stated in our issue just referred to, the motor is a commutator machine which starts from rest as a repulsion motor and operates under speed as a combined compensated-series and repulsion motor.

The repulsion-series motor has recently been applied to heavy locomotive service by the General Electric Company, which has built the locomotive illustrated above in Fig. 7. The locomotive is of the articulated type, with two driving axles and a four-wheel pony truck to each section. The locomotive is equipped with four 400-hp repulsion-series motors mounted on the truck frame over the jack-shafts, to which they are geared at both ends. Cranks on the jack-shafts are connected to the driving wheels by means of connecting rods, each motor having its own pair of drivers, as shown.

Progress of Work of California Committee on Inductive Interference

The committee representing the electric-wire interests of California, authorized by the State Railroad Commission to investigate inductive interference between power and communication lines and to make recommendations for commission rulings to prevent undue interference, has had a force of five to eight experimenters and computers in the field since the first of the year. This staff, which is engaged in collecting and computing data, is equipped with a large amount of apparatus, including an oscillograph having three vibrators, noise standards, an impedance bridge, complete equipment for harmonic analyses, and instruments of various kinds. The total value of this apparatus approximates $9,000.

Harmonic analyses are made by two methods. The first employs the oscillograph, the recorded waves of which are greatly improved by a distortion circuit, containing inductance and capacity, which distorts the harmonics approximately according to the square. The second method employs a resonant shunt, utilizing a circuit which contains inductance and capacity so chosen that in combination with the capacity of the telephone line the whole circuit can be made to resonate for any particular frequency or harmonic whose magnitude it is desired to measure. The tiny currents so obtained, which are too small for direct measurement, are passed through a telephone receiver, and the amount of noise produced therein is equated with the noise developed by a current of sinusoidal wave shape derived from a Vreeland oscillator. The noise standard referred to measures volume of sound by equating the noise set up by the complex induced wave with the noise produced by a pure 240-cycle sine wave.

The parallels on which this investigation work has been completed are four in number, all involving the main trunk line of the Bell system between San Francisco and Los Angeles. This lead comprises ten copper physical circuits, part being loaded and some being made into phantoms. The high-tension exposures, all of 60-cycle frequency, are: (1) a 57,000-volt line, 20 miles long; (2) a second section of the same line, 8 miles long; (3) a 22,000-volt line, 16 miles long, and (4) a 33,000-volt line, 40 miles long.

In all cases the telephone line is on one side of a public highway and the power lines are on the other side, with an average separation of 60 ft. The power lines of the two separate companies also overlap for 10 miles, and since they are operated from sources not in synchronism and neither one can be shut down to enable the influence of the other to be independently measured, the difficulties of analyzing inductive effects have been greatly increased. Again, since both telephone and transmission lines are parts of main trunks, the difficulty of isolating sections of these lines has added to the difficulties of testing.

The Sierra transmission system is operated with a solidly grounded neutral, enabling the investigators to make a thorough comparison of the inductive effects of, first, a neutral ground beyond one end of the exposure, and, second, a neutral ground beyond each end of the exposure, the latter condition giving a return path through ground for unbalanced currents in the line conductors. On the other hand, the Coast Counties system is operated without a grounded neutral, affording a certain number of comparative data between grounded systems and ungrounded systems.

Thorough investigations have also been made of residual and balanced currents and voltages in the power systems, of the shielding effects of other wires on the telephone lead, of the existing transposition systems in both the power and telephone lines, and of the relative locations of the power and telephone transpositions.

Analysis of the inductive effects has proved laborious on account of the large number of different forms of induction in action simultaneously. These may be listed as: (1) electrostatic and electromagnetic, (2) effects of balanced and of residual currents or voltages, and (3) longitudinal and transverse induction.

Longitudinal induction is that which sets up an emf between a wire and ground or a current through a wire with a ground return; transverse induction is that which sets up

INTERIOR VIEW OF LABORATORY, SHOWING TESTING APPARATUS

an emf between two wires or a current in a circuit made up of two wires without a ground connection. Obviously, transverse induction is of chief interest in telephonic interference. Each form of induction, both transverse and longitudinal, is due in part to electrostatic and in part to electromagnetic influence. Any one of the four effects of transverse electrostatic, transverse electromagnetic, longitudinal electrostatic and longitudinal electromagnetic is also due in part to balanced currents or voltages and in part to residual currents or voltages. In order, therefore, to make a complete study of transposition each of the eight effects must be considered independently. The transposition problem is further involved by the necessary transposition of the telephone wires between themselves to avoid cross-talk, which in itself becomes elaborate on a heavy load.

For the exposures so far investigated it has been impossible to get enough transverse induction to obtain oscillograph records for harmonic analysis. The study has therefore been limited to results from the noise standard and the resonant-shunt apparatus. Use of the latter involves successive measurements of harmonics, and between times it has been found that the load and wave-shape of the power system vary. The investigation has thus resolved itself into a determination of the residual voltage and currents on the power system, which are minute compared with the main voltages and currents. And this has in turn required elaborate study of the errors introduced by current and potential transformers in the case of the higher harmonics.

The joint committee has a membership of fifteen engineers, part of whom represent the power interests, part the communication interests and part the commission. Funds have been contributed by both the power and communication interests.

So far as can be determined by the committee, no similar investigation has ever been undertaken on a scale comparable with this work either in magnitude or thoroughness. The study has developed into an investigation of much greater scope and complication than was originally anticipated. Although eight months have already been spent in active work, the investigation has not yet covered a sufficient number of exposures of different characteristics to allow of any general conclusions. The complications of the problem now appear to make extremely difficult the drafting of any general remedial measures which shall not be onerous to the interests involved, and yet not subject to so many exceptions and alternatives as to make them ineffective, but the committee expects that with sufficient time and financial assistance this work can be made to serve as a basis of rulings which will be not only helpful to the communication interests but also to the power interests in the way of standardization of construction and operating methods and the reduction of interruptions to service. Members of the committee also feel that, more important than the above, the work will enable the California Railroad Commission to hand down rulings which will in future reduce harmful agitation, legislation and litigation.

Public Service Commission News

Massachusetts Commission

The Board of Gas and Electric Light Commissioners of Massachusetts has authorized the Suburban Gas & Electric Company, of Revere, to issue $210,000 additional stock to meet the cost of improvements. The company desired to issue $239,000 stock, but the board states that, in view of the uncertainty as to the precise amount of future expenditures for extensions, consideration of so much of the petition as relates to new stock for future use may be deferred without prejudice until the expenditure has been made and the reasonable necessity for the issue can be shown more clearly. The commission points out that under ordinary conditions in a prosperous company where such expenditure, as it becomes necessary, can be financed readily otherwise, the approval in advance of additional stock for such a purpose is of doubtful expediency.

The board has approved an issue by the Worcester Electric Light Company of 1000 shares of stock at $200 to meet improvement costs. In support of its petition the company submitted a statement of probable expenditures for plant additions amounting to about $180,000. The board states that it may be assumed that these expenditures are desirable and needed properly to meet a public demand and satisfy the public convenience, but that an issue of new stock on this account does not appear as necessary at present. Available earnings in excess of operating expenses, interest and dividends have been ample to provide all expenditure for new plant made in the first half of the present year. The board points out that the obvious purpose of the restrictive statutory provisions as to the issuance of stock is to limit its amount to the actual needs of the corporation. The company is advised to renew its application for stock to cover anticipated outlays after the latter have been incurred.

WISCONSIN COMMISSION

At the request of the People's Land & Manufacturing Company, of Oconto, the Wisconsin Railroad Commission has taken a hand in the controversy between the petitioner and the Oconto Electric Company and has ordered a uniform schedule of rates to be put into effect by both companies. After the failure of the two companies to consolidate in 1911 a campaign of competition and rate cutting set in which has reached the point where the petitioner says it can no longer meet the rates established by the Oconto Electric Company without putting its business in jeopardy. The commission's investigation showed that competition has so reduced the resources of both utilities that the conditions in which they are now found can no longer be justified by proper public policy. The rates prescribed by the commission at this time are designed to put an end to competition and are not such as will yield a reasonable return upon the investments. The following rates for electric lighting were prescribed for both companies:

A service charge of $1.10 gross or $1 net per month per active kw of connected load.

An energy charge of 6 cents net per kw-hr. for the first thirty hours' use per month of the connected load, 4 cents net for the next sixty hours' use per month, and 2 cents net for all energy used in excess of ninety hours per month.

In Class A, consisting of residences, the active connected load is to be taken as 60 per cent of the first 500 watts and 33.3 per cent of the excess; in Class B, consisting of all installations not included in Classes A and C, the active connected load is to be taken as 70 per cent of the first 2.5 kw and 55 per cent of the remainder; in Class C, consisting of public buildings, hotels, churches, theaters, etc., 55 per cent is to be taken as active.

The minimum bill, which was abandoned during the competition, is to be $1 per month.

The power rates are to consist of a service charge of $1 gross or 75 cents net per active horse-power per month, an energy charge 2 cents net for current used equal to or less than 25 kw-hr. per month per active horse-power connected, and a charge of 1.5 cents net for all excess. The active load is to be taken as 90 per cent of the first 10 hp, 75 per cent of the next 20 hp, 60 per cent of the next 30 hp and 50 per cent of all over 60 hp.

After an investigation on its own motion, the commission has ordered the Janesville Electric Company to improve its service immediately. The commission called attention to the fact that similar orders made in the past have not been complied with and that a failure to do so in the present instance will be followed by an immediate prosecution by the Attorney-General under the provisions of the public utility law. The order provides that the utility must make a detailed report, both to the commission and to the consumer who initiated the present investigation, of all interruptions of service, with the cause and duration of the same, until the commission is assured that the proper improvements in equipment and distribution systems have been made.

VERMONT COMMISSION

The New England Telephone & Telegraph Company and more than 100 subsidiaries have been summoned before the Vermont Public Service Commission at Montpelier to show cause why an order of the board establishing maximum rates of $18 to $33 for business telephones and $12 to $24 per annum for residence telephones, with a 10 per cent reduction in toll rates, should not go into effect Dec. 1. A large array of counsel and experts have been called into the case, and the full board is considering it.

INDIANA COMMISSION

The Public Service Commission of Indiana has approved the lease of the Indianapolis Gas Company by the Citizens' Gas Company. In approving the lease the commission stipulated a number of terms, among them one providing that rates and dividends shall be on a scale plan. This plan will be much in use hereafter in Indiana, it is probable, in mergers of practically all public utility companies.

The plan provides for the graduated decrease or increase in the rate of return on the investment as the rate to the consumer increases or decreases. In the present instance the plan is that when gas is sold by the consolidated company at 55 cents per 1000 cu. ft., which is to be the price after Jan. 1, 1914, the return to the owners of stock in the leased company shall be 6 per cent. When gas sells at 50 cents the return shall be 6½ per cent. When gas sells at 45 cents the return is to be 6¾ per cent, remaining there no matter how far the price of gas descends thereafter. The commission has not specifically applied the descending rate of return in this case.

The Public Service Commission of Indiana has decided a case in which the Hawks Electric Company, of Goshen, sought to enjoin the city of Goshen by means of a commission order from expending money to rehabilitate its municipal plant. Two points in the decision established precedents for the commission on matters which had been in controversy since the commission's formation last spring. These points were to the effect that such a commission as the Indiana body had no injunctive power of any sort and that the commission has no power to order a city or other utility owner to stop work on a rejuvenation of its plant, even when that work amounts practically to the building of a new plant, on the ground that the new plant will mean wasteful competition.

The city of Goshen has operated an electric lighting plant for many years and at the time of filing the complaint in this case operated its plant in connection with a municipal water plant.

The Hawks Electric Company asked the commission for an order in the nature of an injunction prohibiting the city from installing machinery and appliances to be used in operating its electric lighting plant.

In the commission's decision it points out that remedy on the same questions might have been had in the courts. Since the case has been presented to the commission the matter has been carried to the courts and is still pending there. The city went ahead with its improvements, which meant practically the construction of a new plant. It proposed to produce energy for industrial purposes. The Hawks company was operating under a franchise given by the city in 1902. The company surrendered its franchise and took an indeterminate permit from the commission, believing that under the utility act it would be immune then from all competition in case the city should seek to rehabilitate its plant. The commission's order points out that the company would have been immune from any new competition, but that the commission had no power to prevent the city from rejuvenating its old plant.

Mr. James L. Clark, commissioner, in his opinion on the case, approved by the other commissioners, said: "As we construe the statute it has no application here when the city is seeking to repair its plant, even though the repairing amounts practically to a reconstruction. If the city were preparing to string new wires only or to set new poles or install a new dynamo, its right to do so would never be questioned. Because it seeks to do all these things at once, no doubt in the interest of economy and better service, this fact does not make the statute applicable. The city is now operating its plant, and under the evidence can continue to do so for some time at least without any repairs of consequence.

"In this case competition already exists. There will be no new competition except in quality of service. It could not be supposed that the Legislature intended to confer judicial powers on this commission to give relief where ample relief had long existed in the courts of the State."

Current News Notes

Decrease in Patents Issued in 1913.—According to the annual report of the Commissioner of Patents, made public Oct. 2, applications for patents in the last year totaled 67,986, the largest on record except for 1912 when there were 69,236. During the year 38,754 patents were granted, and 5166 trade-marks, 664 labels and 254 prints were also registered.

* * *

A Veteran Incandescent Lamp.—Mr. S. H. McDowell, of Welland, Ont., reports that a 16-cp incandescent lamp still in use at his home has been in almost continuous service since 1901. The lamp was first operated in Barrie, Ont., and later at Toronto, and has since been in practically nightly use. Mr. McDowell believes this lamp holds a world's record.

* * *

Pennsylvania Railroad Safety Exhibit.—For the instruction of its employees the Pennsylvania Railroad held an elaborate exhibit of safety appliances and methods at its New York terminal Sept. 26. Besides the display of approved mechanical and electrical apparatus, practical demonstration was given of the work of resuscitating a workman who accidentally suffers a shock from the third-rail.

* * *

The Electric Belt Again.—A laconic answer was given recently by Dr. W. A. Evans, formerly commissioner of health for Chicago, who conducts the "How to Keep Well" department of the Chicago *Daily Tribune*. An inquirer wanted to know whether the use of an electric belt would raise the blood pressure in the case of rheumatism or paralysis. The response was as follows: "No; neither will it lower it. The only effect will be on the pocketbook."

* * *

Widening and Deepening of the Welland Canal.—The Canadian government has voted an initial appropriation of $2,000,000 for deepening and widening the Welland Canal, connecting Lake Erie and Lake Ontario, so that it will be not less than 25 ft. deep and not less than 200 ft. wide. The Niagara peninsula of the Province of Ontario has experienced a decided industrial awakening since the water-power of Niagara Falls and DeCew's Falls has been made available by electrical transmission. The shipping facilities of the canal, therefore, have become of greatly increased importance. It is said that the total cost of the improvement will run to $50,000,000.

* * *

Voting Device for Congress.—An electrical voting system is under consideration by the rules committee of the House of Representatives at Washington. Under this plan members of the House would record their votes by pressing buttons on their desks. The votes would be indicated on a board in front of the Speaker's desk. The object of the device is to save time. From forty to fifty minutes is consumed in calling the roll of 435 members under the present arrangement. With the improvement it is calculated that only a few minutes would be needed. With the improved device each member would control four switches labeled, respectively, "aye," "no," "present" and "paired."

* * *

Radio-Telegraphy Publications.—Persons interested in radio-telegraph stations may secure from the Department of Commerce, Washington, or from the radio inspectors in Boston, New York, Baltimore, Savannah, New Orleans, San Francisco, Seattle, Cleveland or Chicago copies of code and abbreviation charts published by the government. These are on cardboard, 8½ in. by 14 in., and show the international Morse code and convention signals and the list of abbreviations to be used in radio-communication. The department also publishes a pamphlet containing a translation of the International Radio-telegraphic Convention, London, 1912, with its final protocol and service regulations. These publications should be in the hands of all experimenters in radio-telegraphy.

* * *

SOCIETY MEETINGS

Colorado Electric Club.—Mr. E. E. Norton, of the Standard Underground Cable Company, Pittsburgh, Pa., addressed the Colorado Electric Club at Denver, Oct. 2, on the subject of the manufacture of electric cables.

* * *

Electrical Credit Association of Chicago.—The annual meeting of the Electrical Credit Association of Chicago will be held at the Hotel LaSalle in that city on Nov. 14, beginning at 2 p. m. In the evening, at 7 o'clock, there will be a dinner to which ladies will be invited.

* * *

Transportation Arrangements for Electric Vehicle Convention.—Mr. F. N. Carle has been appointed master of transportation for the coming convention of the Electric Vehicle Association of America to be held in Chicago on Oct. 27-28. Mr. Carle is arranging for a special train to leave New York on the afternoon or evening of Saturday, Oct. 25.

* * *

Meeting of Pittsburgh Section of A. I. E. E.—The meeting of the Pittsburgh Section of the American Institute of Electrical Engineers on Oct. 14 will be addressed by Mr. H. O. Swoboda, consulting engineer of Pittsburgh, who will present a paper on "The Design, Construction and Operation of Electric Heating Apparatus." The paper will be illustrated by lantern slides, and a number of prominent engineers have been invited to take part in the discussion.

* * *

Institute of Radio Engineers.—The second Institute meeting of the current season was held at Columbia University, New York, Wednesday evening, Oct. 1, after a well-attended informal dinner. A paper entitled "Some Recent Radio Sets of the Marconi Company," illustrated by lantern slides, was read by Mr. Roy A. Weagant. Mr. Weagant has been engaged in the design of the apparatus he described, and his comments were therefore of especial interest. The next meeting will be held on Nov. 5.

* * *

Montreal Electrical Society.—The following is the tentative program for the winter session for the Montreal Electrical Society: "The Conduit Situation in Montreal," by Mr. G. M. Gest; "Induction Motors," by Mr. B. T. McCormick, of the Canadian Allis-Chalmers; "Fire Alarm Systems," by Mr. L. E. Hamilton, of the Northern Electric & Manufacturing Company; "The Marconi System," by Mr. A. E. Reoch, of the Marconi Wireless Telegraph Company of Canada; "Transformers," by Mr. G. P. Cole of the Canadian Allis-Chalmers.

* * *

Philadelphia Section, I. E. S.—The Philadelphia Section of the Illuminating Engineering Society will hold a joint meeting with the Photographic Society of Philadelphia on Oct. 17 at 8 p. m. at the Engineers' Club. Prof. George H. Hoadley, the newly elected chairman, will preside at the meeting. Mr. W. J. Serrill will give a report of the recent Pittsburgh convention of the I. E. S., and Prof. A. W. Goodspeed will present a paper entitled "A Simple Unit Method for Measuring the Intrinsic Actinicity of Flame and Surfaces and for the Practice of Photography."

Hydroelectric Energy for Worcester Railway System—II

Arrangement of switching equipment and railway substations—Use of large 60-cycle rotary converters—Operating methods which are employed in the system

IN the preceding article there was described the supply of 120,000-volt hydroelectric energy from the lines of the Connecticut River Transmission Company to the system of the Worcester (Mass.) Consolidated Railway Company. An account of the railway company's steam-plant generating facilities was also presented. The following paragraphs describe the distribution, conversion and utilization of this energy in the operation of the electric railway.

The railway company's switching station at Millbury is a brick and concrete structure, 90 ft. long by 19 ft. wide, and one story in height. It houses the 25-cycle and 60-cycle, 13,200-volt feeder buses and motor-driven remotely controlled switches governing the outgoing lines to the Madison Street, Texas and associated substations. The operating switchboard is located in the turbine room of the power plant. The central portion is occupied by the bus, oil-switch and disconnecting-switch compartments, the series and shunt transformers being placed below the floor level in concrete compartments and runways. These are easily reached by raising slate slabs 2 in. thick. Incoming lines are brought to the building in conduit, crossing the canal outside the power station. The outgoing feeders pass under the floor and out to the roof through disconnecting switches and roof bushings. Besides the two circuits from the Millbury plant to the Madison Street substation, the company is now installing a double three-phase line of No. 1 copper on a single set of poles between Millbury and the Texas substation. By means of this circuit 25-cycle energy will shortly be supplied to Texas, Leicester and Charlton City and to the Webster substation. The line is designed for 33,000 volts, but for the present 13,200 volts will be employed. The Sturbridge substation is at present supplied from Charlton City. Double-current generators are now in service at the latter point, but this substation will also be supplied from the Millbury lines later.

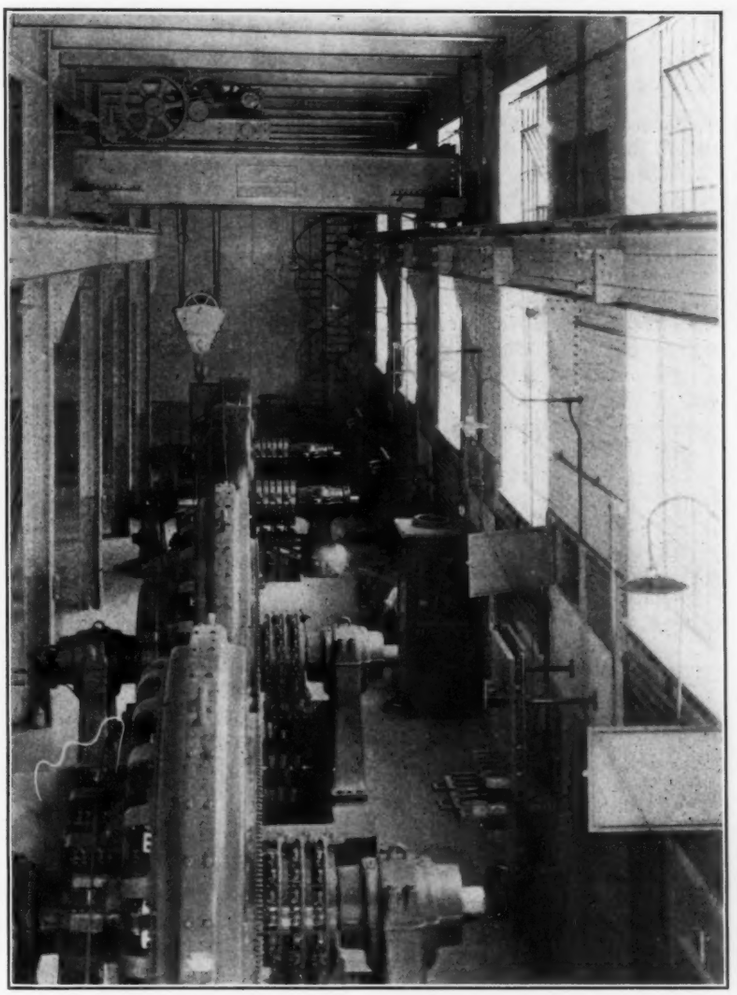


FIG. 1—MADISON STREET SUBSTATION, WORCESTER, MASS.

The Madison Street substation in Worcester was originally large enough to house its present equipment, which is noteworthy through the use of 2000-kw, 60-cycle rotary converters built by the Westinghouse Electric & Manufacturing Company. These machines were among the first of their size placed in electric-railway service to be designed for 60-cycle operation. Each occupies a space 10 ft. 11 in. long by 9 ft. 3 in. wide, the extreme length of the machine along the shaft and including the end-play device being 11 ft. 7.5 in. Each has eighteen poles and operates at 400 r.p.m., having six-phase connections on the alternating-current side. On the direct-current side the machines each deliver 3333 amp at 600 volts, normal rating. They are provided with series, shunt and interpole field windings, and their guaranteed efficiencies are as follows:

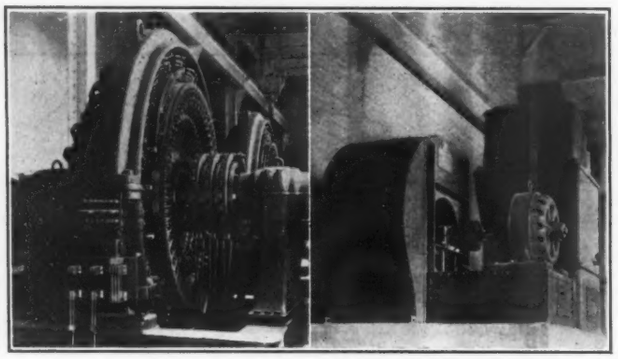
Per Cent Load	Per Cent Efficiency
50	85.5
75	91.3
100	94.6
150	95.2

The machines are arranged for automatic compounding by the usual combination of series excitation and inductance coils placed in the transformer secondary leads. Each rotary is provided with a brush-lifting device controlled by a hand lever, and this is used in starting the machine as an induction motor, the starting switches being operated by remote control from panels on the ground floor of the substation. Two pilot brushes are left in circuit in starting each machine. The brushes are of an imported carbon and copper composition type, each having four shunts and a locking device. Three voltage steps are used in starting, the full pressure being 430 volts. Each brush to be lifted is fitted with a rack in which a spring-hinged hook engages

when the lifting lever is shifted toward the raised position. The lifting arrangement is entirely independent of the brushes during normal running. Each brush is merely raised and lowered within its own holder so that the commutation is not altered.

Incoming Lines and Transformers

The incoming lines from Millbury terminate in a light-



FIGS. 2 AND 3—2000-KW WESTINGHOUSE CONVERTERS, AND TRANSFORMERS FOR THESE ROTARIES, MADISON STREET

ning-arrester house adjacent to the substation, from which underground cables are run to the second story of the latter. With 15-in. spacing between conductors, one line is carried on insulators supported on 1½-in. pipe framing, 12.5 ft. above the floor, to Westinghouse type E 15,000-volt automatic oil switches. The leads from the switches thence pass through wall bushings of porcelain to the transformers supplying the two 60-cycle rotaries. Corresponding switches control the transformers for the 25-cycle rotaries, which are supplied from the other incoming line. The current transformers are placed in the incoming lines just inside the cable pot-heads, and an automatic oil switch is included in each line, disconnecting switches being installed between the main-line oil switches and those controlling the sets of transformers for each rotary. Individual current transformers are provided in each transformer primary circuit. The oil switches controlling each bank of transformers for the 60-cycle service are housed in concrete compartments 31 in. long and 12 in. wide per phase, the over-all width being 50 in. The trip coils are installed at the rear of the compartments, and the ends of the lat-

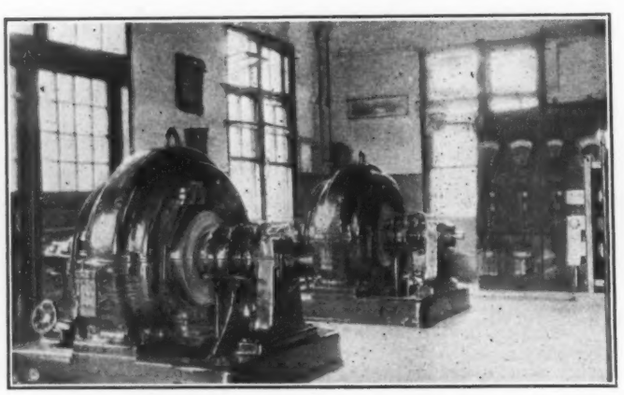


FIG. 4—WEST BOYLSTON SUBSTATION

ter are protected by vertical concrete slabs measuring 56 in. high and 6 in. wide. These also serve as foundations for the pipe framing on which the local disconnecting switches and current transformers are supported. The oil switch and bus room is 120 ft. long and varies in width from 14 ft. to 2 ft. on account of the shape of the building.

The transformer installation consists of three 700-kva, 13,200/430-volt Westinghouse air-blast type units for each 2000-kw rotary and two sets of three 550-kw air-blast General Electric units for the smaller rotaries. They are all located on top of a brick air duct in the second story of the building immediately above the operating room. The smaller banks are ventilated by a Buffalo blower direct-driven by a 7.5-hp General Electric induction motor, and the larger sets by a No. 70 Sirocco blower direct-driven by an 11-hp Westinghouse induction motor. The secondaries are connected in Y, and the series reactances in each of the larger transformer circuits are installed in the air duct below the transformers, facilitating the ventilation of the reactances and economizing in space. The air outlets for the reactance coils are located in the transformer bases, and a hood is also provided by which the air is deflected from the reactances to the room without passing into the transformer interior ducts. The transformer room is 126 ft. long by 14 ft. wide, and the air duct is 6 ft. by 9 ft. in

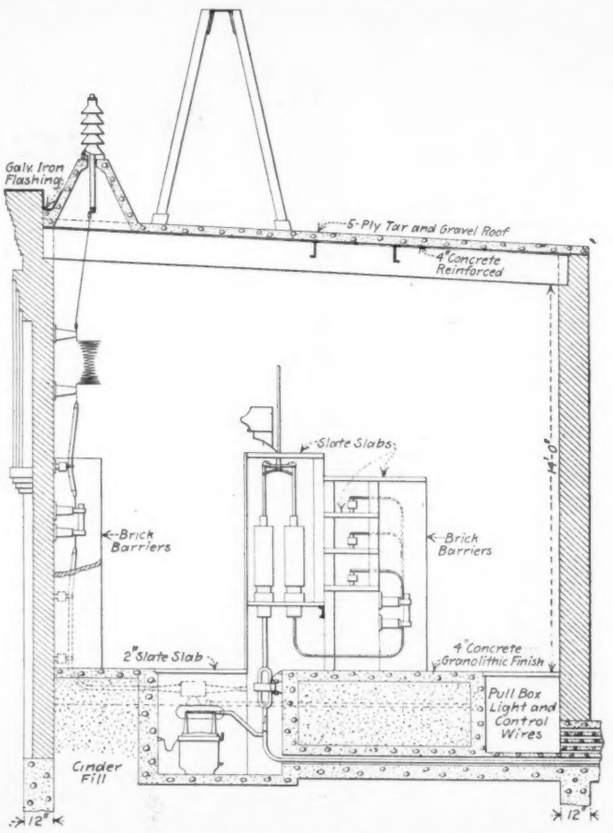


FIG. 5—SECTION OF MILLBURY SWITCH HOUSE

outside dimensions, with a division wall between the two fan systems.

Arrangement of Switchboard at Substation

The present switchboard at Madison Street contains twenty-four 16-in. feeder panels, one 20-in. totalizing panel, four 20-in. rotary panels, and four spares, with a 4-ft. space at the rear to facilitate inspection and repairs. Each new rotary panel contains a 4000-amp Thomson watt-hour meter, main switch, field rheostat handle, circuit-breaker and ammeter. The alternating-current panels for the new rotaries each contain a set of starting switches, a 200-amp ammeter, overload shunt-trip relay and pilot lamps showing the position of the 13,200-volt oil switches on the second floor. These panels are located against the wall at the side of each 2000-kw rotary. Field-reversing switches and equalizer and positive and negative switches are all mounted on the rotary frames. The totalizing panel on the main switchboard contains a 15,000-amp ammeter, a

750-volt voltmeter and a curve-drawing ammeter and voltmeter of the same type. There are eleven 500,000-circ. mil, 600-volt tie lines between Madison Street and the Fremont Street stations which facilitate the equalization and emergency handling of loads in the city of Worcester. Low-tension alternating-current cables between transformers and rotary starting panels are run in ducts built into the substation wall, with pull boxes opening onto each floor.

The Leominster, West Boylston, West Berlin and Northboro substations are each supplied with energy from the Clinton substation of the transmission company through a three-phase No. 1 copper line carried on wooden poles and owned by the Consolidated company. Disconnecting switches are installed at convenient points in these lines for sectionalizing purposes. The poles are of chestnut, 35 ft. in length, set on the average 100 ft. apart, and the line is supported on Locke No. 315 insulators carried on a 10-ft. cross-arm. The substations are designed along standard lines, the 300-kw rotary being the usual unit of equipment. The West Boylston installation, shown in the accompanying photographs, is representative and consists of two 300-kw Westinghouse rotaries, six 110-kw General Electric 13,200/

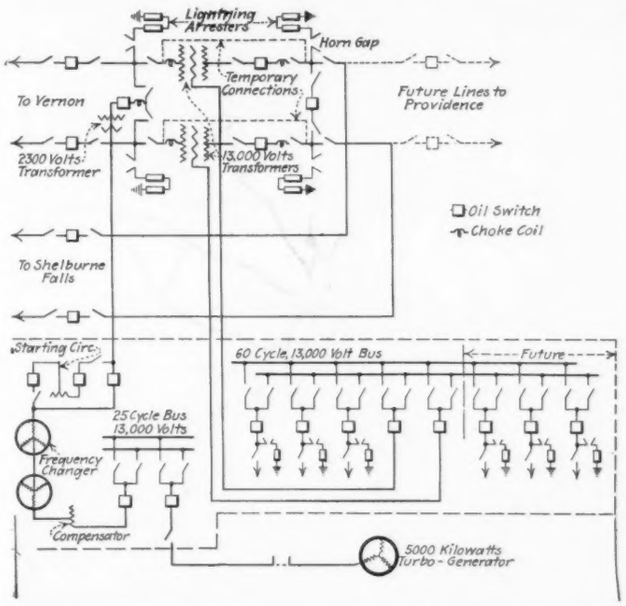
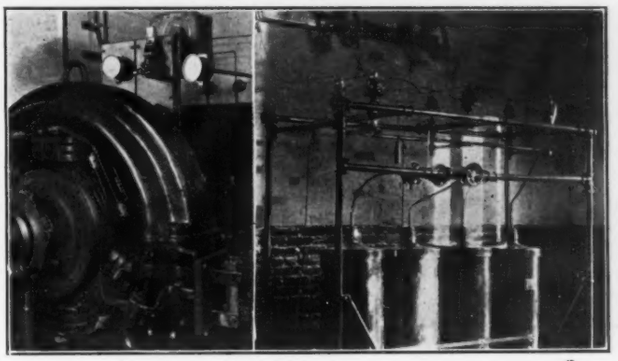


FIG. 6—DIAGRAM OF CONNECTIONS, MILLBURY SUBSTATION

370-volt oil-cooled transformers, two 45-kw reactance coils and a four-panel switchboard 5½ ft. long, housed in a concrete and brick building which is 40 ft. by 30 ft. in inside dimensions.

The incoming line is brought through choke coils and selector switches with multigraph lightning arrester connections, the transformers being arranged in a single row with the rotaries in front. The usual direct-current feeder equipment is installed on the switchboard panels. Automatic oil switches are installed in the transformer primary leads and practically the entire equipment is in sight on the working floor of the building. The telephone facilities include both public and private lines. At Fitchburg a 300-kw rotary converter with three 110-kva oil-cooled transformers and auxiliary equipment is housed in a 19-ft. by 21-ft. brick extension of the Connecticut River Transmission Company's main 9000-kw substation in the outskirts of the city. A switchboard with two 16-in. panels, one for the alternating-current and the other for the direct-current side of the rotary, is in service, a single 500,000-circ. mil feeder being all that is needed for the Consolidated service in this district. The compactness of the arrangement is noteworthy.

At Northboro a typical substation built in connection with an established steam-generating plant now held for auxiliary service is in operation. Here there are two 300-kw rotaries, with transformers and auxiliary apparatus installed in a section of the engine room 19 ft. by 55 ft. in dimensions. In this substation the arrangement of incoming line and choke coils is unusually straightforward. The wires are



FIGS. 7 AND 8—300-KW ROTARIES, FITCHBURG SUBSTATION, AND LIGHTNING ARRESTERS, WEST BERLIN SUBSTATION

carried on insulators supported on pipe framing after being brought into the building through roof bushings housed in 30-in. by 36-in. inclined openings. The choke coils are mounted on horizontal axes on insulating supports carried on the framing as shown, and the utilization of space otherwise of no value is of interest. The negative and equalizer buses are installed under the floor of the substation, and the switchboard controls the direct-current supply to feeders caring for the power demands of cars operating in the Marlboro, Northboro, Westboro and Shrewsbury district. The alternating-current sides of the rotaries are controlled from separate panels near the machines.

The company's double-circuit 33,000-volt line construction employs a standard pole about 35.5 ft. high above the rail. The high-tension wires are spaced in 36-in. equilateral triangles and are carried on pin-type insulators on 7-ft. and 12-ft. cross-arms with metal braces. The feeders are carried on 5-ft. arms spaced 24 in. apart; the trolley brackets are 9 ft. 6 in. long on tangents, and a telephone cross-arm 3 ft. long is provided immediately above the latter. At crossings double cross-arms are installed and the insulators

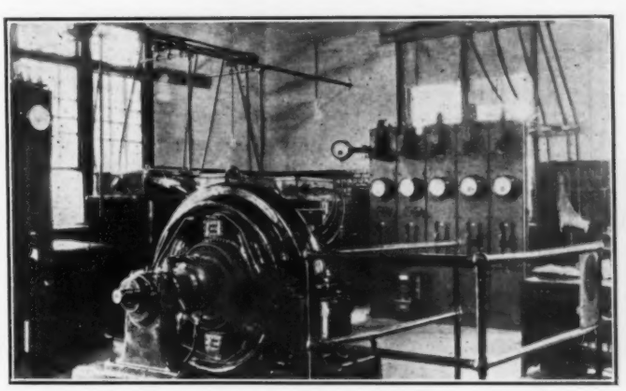


FIG. 9—200-KW ROTARY AND SWITCHBOARD, NORTHBORO

are spanned by Thomas No. 7111 line-wire protectors.

At Millbury Junction, Mass., the 66,000-volt lines of the Connecticut River company cross the tracks of both the Consolidated company and the Boston & Albany Railroad. The arrangement of suspension insulators in the second-named crossing deserves mention. Each phase wire is attached to three insulators at the ends of the cross-arms of

75-ft. steel towers anchored on each side of the span, the latter being about 170 ft. in length. The conductors are hung 10 ft. apart in a vertical plane and about 16 ft. apart horizontally. Suspension insulators of the five-disk size are used to carry the strain of the No. 00 line wires employed in this crossing. The 25-ft. span across the Con-

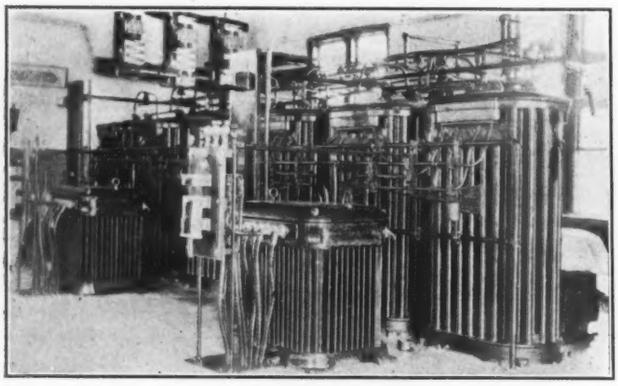


FIG. 10—TRANSFORMERS, REACTORS AND 13,200-VOLT BUSES, WEST BOYLSTON SUBSTATION

solidated track is effected by the use of a pair of A-frames about 50 ft. high, carrying pin-type insulators.

Plant Operating Practice

The Fremont Street station, containing the original engine-driven generators of the Worcester lines, now has seven engine-driven units installed. All are of the cross-compound condensing type, with twelve water-tube boilers. This station has a coal-storage yard of 20,000 tons capacity and is located alongside the main line of the Boston & Albany Railroad in the southern part of Worcester. An extensive coal-handling system is in service at this point, but no further description need be given here of the company's steam plants, for these are gradually being retired in favor of hydroelectric service, with the exception of the turbine station at Millbury. It is the company's practice to operate an 850-kw engine-driven generator at Fremont Street to handle the requirements of all-night operation on the system. Hourly cars are operated on the principal streets of Worcester throughout the night, and the trolley is maintained alive elsewhere. All substations are shut down about midnight and started about 5:30 a. m. At the

DAILY STATION LOG SHEET.

Railway Company. Station.

Ending Midnight 191

LABOR	AMOUNT	QUANTITY	MATERIAL	AMOUNT	PERFORMANCE
Motormen @ Per Day			Lbs. Bark Coal @ Per Ton		Max. S. W. reading observed
Engineers @ " "			" Coal " @ " "		Max. A. C. ampere reading observed
Firemen @ " "			Bals. Syl. Oil @ " Gal.		Max. D. C. ampere reading observed
Switchboard @ " "			" Eng. " @ " "		Max. voltage reading observed
Helpers @ " "			" " " @ " "		Min. voltage reading observed
Pitmen @ " "			" Dynamo Oil @ " "		Total Boiler Hours
Water Tenders @ " "			Lbs. Waste @ " Lb.		" Lbs. Water Evaporated
Coal Laborers @ " "			" Waste @ " "		" " " per Kilowatt-Hours
@ " "			" Rags @ " "		" " " Lb. of Coal
@ " "			Incandescent Lamps @ " Per Lamp		Average Temperature of Feed Water
@ " "			Small Supplies, Incidentals "		Rated Output of Units, Operated on Dec. C.
Total Cost of Labor, Operation			Cu. Ft. Water @ ——— Cu. Ft.		Ratio of Actual Output to Rated Output
No. Men Employed			Expenses, Supplies, Repairs, Steam Equipment		Total Kw.-Hour Output of Station
Labor for Repairs, Steam Equipment			" " " Water "		" " " per Man
" " " Water "			" " " Electricity "		Coal Consumed per Kilowatt-Hour
" " " Electricity "			Total Cost of Material		
Cost of Labor per Kw. H., Operation			Cost of Coal per Kw. H.		
" " " Cy. & Repairs "			Cost of Material per Kw. H., Operation		
			" " " Cy. & Repairs		

Total Cost of Current per Kilowatt-Hour

Approved Foreman

Chief Engineer.

FIG. 11—FORM OF DAILY GENERATING STATION AND SUB-STATION LOG SHEET

Charlton City plant one of the existing double-current generators will be utilized as a rotary converter in the fall, but the night service will continue to be handled from Worcester as above outlined.

Daily generating station and substation logs are kept, the latter exhibiting with considerable detail the meter readings at the starting and stopping of all rotaries, maximum volts and amperes, minimum voltage, hours of machine operation, reports of switches opened, with authorization, records of power off the direct-current bus, opening of circuit-breakers, and charging and condition of lightning arresters. In general, substations containing one or two rotaries are operated by two men on twelve-hour daily shifts.

The steam-plant organization is somewhat unsettled in view of the expansion of the Millbury station and the use of purchased power, but as a rule the organization of such plants follows the usual lines of a chief engineer and three watch engineers, with subordinates depending in number and duties upon the character of the load. The Madison Street substation will require one chief operator, two assistant operators and probably three additional assistants when the installation of the 2000-kw rotaries is fully completed. The size of the system permits more or less interchanging of operators. The work of the department of power stations is in immediate charge of a superintendent,

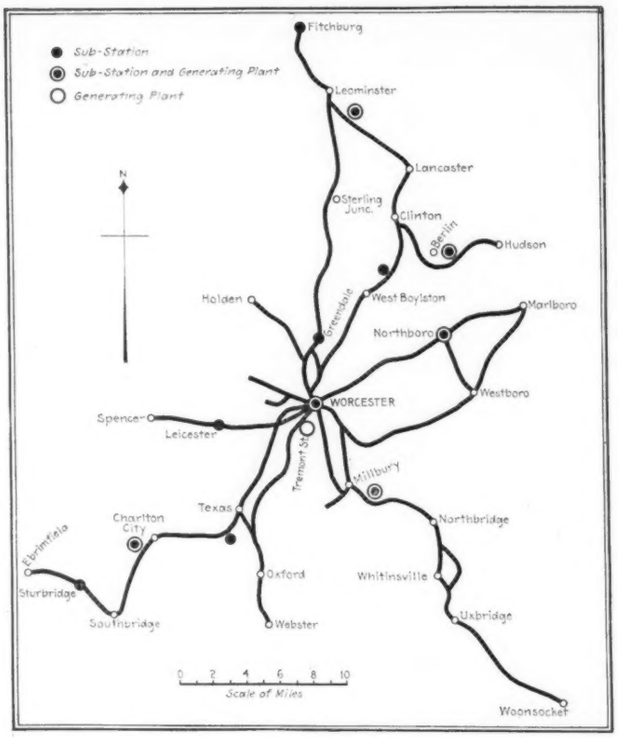


FIG. 12—MAP OF MAIN LINES, WORCESTER CONSOLIDATED STREET RAILWAY COMPANY

whose headquarters are at the Market Street carhouse in Worcester. All chief operators and chief engineers report to this point. Mr. W. M. Finlayson is superintendent of power stations, and Mr. Henry C. Page is general manager of the Worcester Consolidated system.

The engineering department of the Worcester-Springfield systems, with headquarters at Springfield, Mass., handled the greater part of the Consolidated company's engineering in connection with the foregoing improvements, which represent an expenditure of nearly $500,000 within the past two years. The engineering of the Connecticut River Transmission Company's system in connection with the improvements at Millbury and its latest steel-tower line construction, as well as the developments on the Deerfield River, was handled by the Power Construction Company, of Shelburne Falls, Mass., Mr. George W. Bunnell being president of the organization. This company also handled the engineering for the 60-cycle rotaries north of Worcester and in the Madison Street substation, subject to the approval of the Worcester company's engineers.

Theory, Design and Operation of Head-Lamps

Articles covering the basic principles of the illumination relations of, the design of light sources for, and the service performance of head-lamps. By Charles R. Sugg, A. R. Dennington and L. C. Porter

Basic Principles of Head-Lamp Illumination

BY CHARLES R. SUGG

It is convenient and customary in discussing matters of the kind under consideration to assume ideal conditions upon which to base a theory, and in this paper point sources of light and reflectors and lens of 100 per cent efficiency will be assumed.

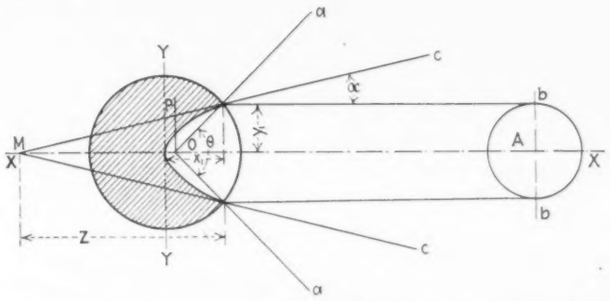


FIG. 1—PARABOLIC REFLECTOR WITH LIGHT SOURCE AT FOCUS

In order to direct all the rays of light projected from a reflector it is necessary that the reflector be so designed that every ray of light impinging on its surface will be redirected in a line parallel with the axis of the reflector. This is done by what is known as a parabolic reflector. In the case of reflected light the source of light must be placed at the focal point or focus.

Assuming the light source to be placed at O in the focus of the reflector (Fig. 1), there will be a cone of light as shown by θ which will not be under the influence of the reflector and will be subject to the law of inverse squares, as is well known, but the remaining light flux, indicated by the cross-sectioned part of the sphere, will fall within the reflector and be projected along the lines *bb* parallel to the axis X. This flux is no longer governed by the law of inverse squares but in a clear non-absorbing medium will be projected to infinity without increase or decrease of intensity. As the direct rays included in the angle are subject to the law of inverse squares and very rapidly become ineffective, it is convenient and not inaccurate to neglect them for the present and consider only the parallel rays.

Assuming the light flux representing the direct rays to be one-fifth of the total flux of the source, then the reflected flux will be four-fifths of the total flux. As 4π is the total flux from a unit light source, the reflected flux will be four-fifths of 4π or $16\pi \div 5$, which will be concentrated within the circle whose diameter is equal to the diameter of the reflector. The area under the assumptions will have constant intensity at all distances from the source. The question "What is the candle-power of reflected light?" is often asked. From the foregoing it is readily seen that as the projected beam does not diminish in intensity the term is a misnomer, but one can state what would be the candle-power of unreflected light placed at the same point and producing the same intensity on an equal area at a specified distance, and as the unreflected light would vary in accordance with the law of inverse squares, the value of the effective candle-power would vary in the same ratio.

If the reflector be so designed as to give a small angle of divergence, α, the law of inverse squares becomes effective again, but instead of making measurements from the center of the source the measurements must be taken from the point M, where the outer rays at the edge of the reflector, if projected backward, cross the X axis of the reflector. This point is the "virtual" center or focus of the light beam. The light flux at the front edge of the reflector can be ascertained, and having the distance Z (Fig. 1), one can determine the candle-power required at M to produce the same light flux. This value of candle-power will be constant for all distances, but it must not be forgotten that all calculations must be based on measurements taken from point M as the origin and not the center of the light source O.

Consider now the projection of light by use of a lens L (Fig. 2), still using a point source located in its focus O and designed to project parallel rays. The same reasoning applies to this as to the parabolic reflector, except that only the amount of light included in the beam is that included in the cone represented by the angle θ (Fig. 2). In order to include more of the light in the beam, one may provide a suitable reflector, as shown at R (Fig. 2). The only type of reflector suitable for this is a spherical reflector located behind the light source at such a distance that its center or focus will coincide with the light source. This reflector will reflect each ray of light back through the light source, thus doubling the intensity of the ray, provided that none of it is absorbed. The discussion relative to the reflected parallel beam and slightly divergent beam outlined under the above paragraph relative to reflectors holds good for the lens both without and with the reflector.

Assume now some concrete cases and apply the above discussion to them, still assuming ideal conditions. Referring again to Fig. 1, take $Y_1 = 9$ in. and $X_1 = 13$ in.; then $P = 1.5$ in. The area of the beam will be 1.75 sq. ft. The total light reflected in lumens is 11.31 times the mean spherical candle-power of the light source, which

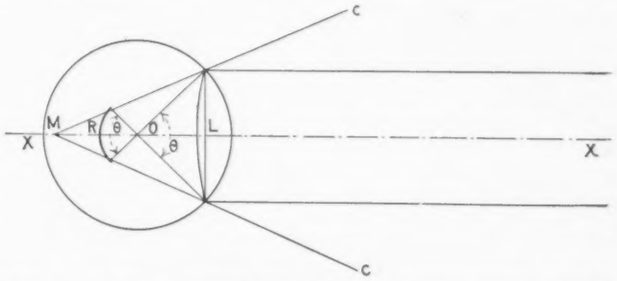


FIG. 2—PARALLEL LIGHT RAYS DELIVERED FROM POINT SOURCE THROUGH A LENS

for an arc lamp may be taken as 650 mean spherical candle-power. The total light flux is 7351.5 lumens, which, divided by 1.75, will give an average of 4200 lumens per square foot over the cross-section of the beam. Assuming a distance of 1 ft. from the source, the candle-power of a lamp at the same point would be 4200 cp, and at 100 ft.,

according to the law of inverse squares, would be 10,000 times this amount, or 42,000,000 cp.

In the case of a divergent ray, if α be assumed as 1 deg., the illuminated field at a distance of 800 ft. will be approximately 28 ft. in diameter, and, using the same arc lamp as specified above, the divergent ray projected backward will cross the X axis at M, approximately 44 ft. from the front of the reflector. The average illumination at the front of the reflector will be approximately the same as for the parallel ray, that is, 4200 lumens per square foot. To produce this illumination by an unreflected light source at M would require a lamp of approximately 8,132,000 cp. The illumination at any other point in front of the reflector may be determined by the inverse-square law by using this value and referring to point M as an origin. One can then refer to the lamp as equivalent to an 8,132,000-cp source.

With an 18-in. lens designed to subtend the same spherical segment as the reflector just described, there will be only 1.26 lumens to be projected and the average intensity of the ray will be 468 lumens per square foot, which, if taken at 100 ft. from the source, would be equivalent to an unreflected lamp of 4,680,000 cp. With a divergent ray of 1 deg., as before, the beam would be equivalent to that from a source of approximately 906,000 cp located at M. By using the reflector R (Fig. 2) the values would be doubled.

The above deductions have been made under the assumption of ideal conditions. In practice these conditions are not realized. A reflector becomes tarnished and absorbs a very large portion of the light; the source is seldom placed in the focus and is not a point, but an area; particles in the atmosphere absorb, reflect and refract the light, thereby diminishing its intensity, the amount of which will have to be determined by experiment. With the lens and reflector a small deposit forms on the inner surfaces and absorbs a portion of the light; it is the writer's opinion that the loss from this source is small in comparison with the loss from a tarnished reflector and from the spread of the light source.

No attempt has been made in this discussion to give values of the coefficients of reflection, refraction or absorption of light for any of the substances or media which are involved in practice, all of which vary under different conditions and must be determined by direct experiment.

Considerations in the Design of Head-Lamp Light Sources

By A. R. Dennington

The rapidly increasing use of incandescent electric head-lamps on automobiles, street cars and locomotives makes of interest in engineering circles a review of the conditions which the lamps must successfully meet.

The older forms of illuminants, oil and gas flames and electric arcs, used in head-lamp work have met more or less successfully the rather exacting conditions and have very largely determined the type of fixtures and reflectors in use at the present time. The incandescent electric lamp, thought it has the advantage of giving no fumes or soot to discolor the reflecting surface and requiring none of the reflector cut away in order to secure ventilation, was not until recently a rival of the electric arc or gas flame for head-lamps. The reason for the incandescent lamp lagging behind was that it has been impracticable to construct a lamp of sufficiently high candle-power having the filament arranged within a space small enough to give good results with a reflector. The advent of the ductile tungsten-filament lamp has made possible constructions with the incandescent material wound in close spirals and supported so as to occupy a very small space, usually within a sphere of 0.25-in. to 0.5-in. diameter. By concentrating the light source within a small space the effect produced by a reflector or lens is very much better than if the light source is larger and irregular.

If all the filament could be placed at the focal point of a perfect parabolic reflector, the light would be projected in parallel rays and the only diminution in intensity with increasing distance would be that due to absorption and dispersion by the dust particles in the atmosphere. Under these conditions the surface illuminated by the beam would be a circle having a diameter equal to the diameter of the reflector. A beam of light having perfectly parallel rays, even if it were obtainable, would be of value only in special cases and would not be suitable for the illumination of the space ahead of a moving carriage or locomotive. As it is impossible to obtain a true point source of light, the rays emanating from the portions of the incandescent filament outside of the focal point of the reflector will diverge as indicated in Fig. 1 by lines *a* or will converge toward a point and then diverge as shown by lines *b*. The diverging rays emanate from portions of the filament in front of the focal point and the converging diverging rays emanate from behind the focal point. The rays from the portion of the light source directly at the focal point will be projected in parallel lines *c*. The amount of divergence in any given case depends upon the ratio of the maximum distance of the incandescent material from the focal point to the focal length of the reflector. As the focal length of the reflector is small, varying from about 0.875 in. to 2.5 in.,

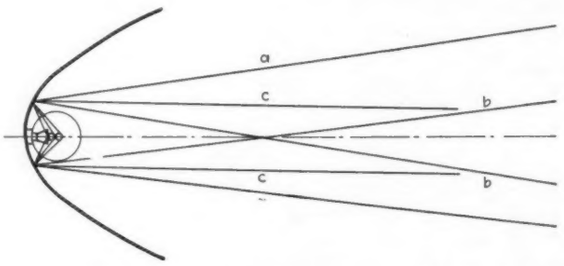


FIG. 1—DIVERGING AND CONVERGING RAYS FROM FILAMENT

it is important to have the over-all dimensions of the filament of a lamp for use in such reflectors as small as possible.

Lamps for automobile head-lamp service are placed in sockets at the rear of the reflector and burn in a horizontal position, while in locomotive service the lamp is, in many instances, held in a vertical position and can be installed in a reflector designed for an electric-arc lamp or an oil lamp. A reflector which is cut away to allow the use of an electric-arc or oil lamp is less efficient than one designed for an incandescent lamp and having the opening for the lamp socket at the apex of the parabola. In every case provision should be made for adjustment of the socket so that the filament can be centered accurately at the focal point. In making up lamps it is impossible to get the filament in exactly the same position in every bulb because of the fact that the glass cannot be worked in exactly the same manner each time.

The curve of distribution of light from a lamp with concentrated filament (Fig. 2) shows that the intensity is fairly uniform except opposite the tip of the bulb, where the intensity falls to a very low value. This result is attributable to the fact that the tip reflects or absorbs practically all the light rays falling on it from the filament and the incandescent area is so small that no direct rays can pass into the dark space *a*. However, the tip is of no special disadvantage when the lamp is used in a reflector, as the non-parallel reflected rays illuminate the space which does not receive any direct radiation from the filament.

A number of points must be taken into consideration in

mounting the filaments for head-lamp service, as the filament must be able to withstand shocks, be within a limited area and have minimum cooling due to terminals and supporting wires or anchors. In the case of automobile head-lamps, where the emf across the lamp terminals is only about 6 volts or 7 volts and the candle-power usually less than 25, the filament is so short and light that it can be counted without any supports excepting the leading-in wires to which the filament is fused, as indicated in Fig. 3. As the weight of the filament is very small, the bending stress at a point *a* near the lead wires is slight and the wire is stiff enough to withstand it without being set into vibration. Moreover, the springs and pneumatic tires of the automobile prevent sharp shocks from being transmitted to the lamp, and therefore the filament remains intact even after it has become brittle by being heated to high temperatures for long periods. There is little danger of the filament becoming broken while the lamp is lighted because the temperature is high enough to make the tungsten wire soft. If the specific consumption of the lamp is too low—that is, if the ratio of the total watts to the mean horizontal candle-power is much less than unity—the filament may be so soft as to sag out of shape with its own weight and the useful life of the lamp is materially reduced.

The service conditions under which lamps for locomotive service operate are much more severe than for automobile service, not only because of the greater severity of the shocks which must be successfully withstood, but also because only a single lamp is in use and because of the necessity for a thoroughly reliable source of light. The electric generators used on steam locomotives have been designed for operating arc lamps and therefore develop pressures of from 25 volts to 35 volts. It is essential that incandescent lamps, at least during the transition period from arcs to incandescents, should be designed to operate at the voltages suitable for the arcs. Though a lower electrical pressure might be desirable from the standpoint of ruggedness of construction of an incandescent lamp, there are disadvantages which may overbalance any gain due to a short, thick filament. With a low-voltage lamp it is necessary to supply a large current in order to get sufficiently high candle-power for head-lamp service, and consequently the difficulties encountered in securing a satisfactory seal between the leading-in wires and the glass are very much increased. The expansion of the wires *a* and *b* (Fig. 4) at the top and bottom of the press or flat portion

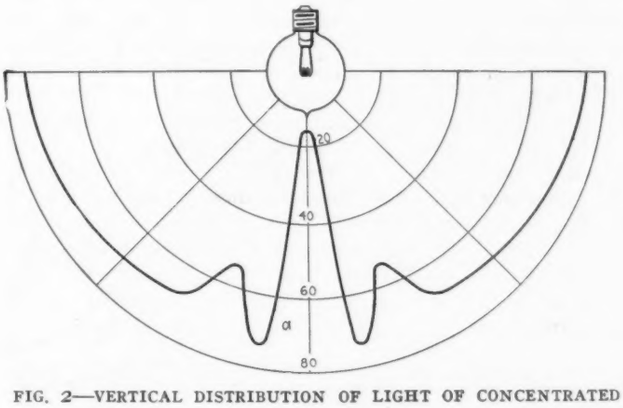
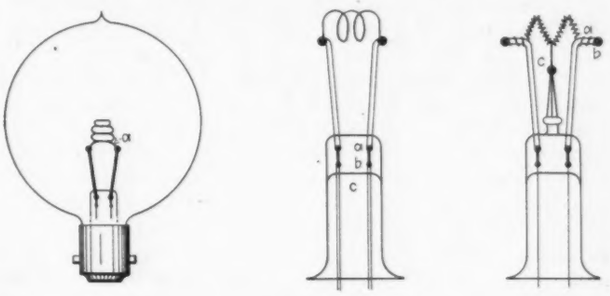


FIG. 2—VERTICAL DISTRIBUTION OF LIGHT OF CONCENTRATED FILAMENT LAMP

of the stem where the wires are sealed into the glass causes a wedge-like action which tends to split the glass. Moreover, in order to embed the large wires properly it is necessary to use heavy tubing for the stem, and this heavy tubing is more difficult to work than light-weight or medium-weight tubing. Special care must be used to prevent stresses being set up in the glass, as these stresses may cause a crack in the completed lamp. The heavy wires supporting the filament bring a stress on the glass whenever the lamp is subjected to a shock in a direction perpendicular to the stem. Shocks of this nature occur frequently in railway service when couplings are made and when heavy freight trains are being started. Instances have occurred where the failure of the lamp was due to the breaking of



FIGS. 3, 4 AND 5—TYPES OF UNSUPPORTED AND SUPPORTED FILAMENTS

the glass at a point just below the lower weld *b* in the stem. The cause of such breakage is generally a combination of the stresses due to manipulation during manufacture and those attributable to a sudden shock or change of temperature.

The filament must be connected to the leading-in wires in such a way as to give good electrical contact and also mechanical strength. Short, thick filaments may be satisfactorily connected to the terminals by fusing the wire into a bead around the end of the filament. However, if the filament is long it is certain to vibrate more or less and thus cause bending at a point near the leading-in wire. The continual bending results in the fatigue of the material and ultimately in breakage. The strengthening of this part of the filament or the distributing of the bending stress is therefore necessary. A method which has been tried, but with indifferent success, is to wrap the filament around itself for a short distance from the supporting wire. This method did not prove satisfactory, even though it did strengthen the wire, as the bending was merely transferred to a point at the end of the wrapping. Much better results can be obtained by wrapping the filament *a* (Fig. 5) two or three turns around the leading-in wire and fusing it at the end *b*. A spiral spring effect is thus introduced which distributes the bending and reduces the fatigue of the material. Vibration or bending of the filament must be eliminated as far as possible, and therefore the intermediate supports or anchors *c* must be rigid. The desired rigidity may be secured by using a tripod of small wires or a single heavy wire, to which is fused or clamped a small molybdenum or tungsten wire which may be brought into contact with the filament. The wire actually coming in contact with the filament should be as small as consistent with the demands for rigidity in order that the cooling effect may be reduced to a minimum, and the number of supports should be as small as possible. The fewer the supports the more nearly uniform the temperature of the filament from end to end and the greater the life of the lamp for any given specific consumption. If portions of the filament are cooled by anchors, the intermediate parts must be heated to a proportionately higher temperature in order to reduce the watts per candle to the desired value.

The actual mean horizontal candle-power of incandescent head-lamps for locomotive service varies from about 50 to 100 or more. Tests have shown that a 50-cp lamp properly focused in a parabolic reflector will enable an engine driver to distinguish an obstruction, such as that represented by two men in dark clothing, at a distance of from 600 ft. to 1000 ft., depending upon the speed of the train and the clearness of the atmosphere. As the speed of the train is

increased the distance at which an obstruction can be distinguished is decreased. The measured distance in a number of tests has been approximately 200 ft. less at a speed of 30 miles per hour than at standstill, other conditions remaining unchanged. The candle-power of lamps must evidently be greater for high-speed than for low-speed service, not only because the danger distance ahead of the train is greater in the first case but also because of the fact that the driver will not be able to distinguish objects as readily as when the speed is low.

The space available for the bulb of a head-lamp is limited by the reflector, and it is therefore necessary to use bulbs as small as possible in order to get the filament at the focal point. If filaments for high candle-power are placed in small bulbs, there is liable to be early blackening and consequently the useful life of the lamp is reduced. However, recent experiments have shown that the tendency to blacken can be largely overcome by using an inert gas, such as nitrogen, at nearly atmospheric pressure instead of vacuum in the bulb. Lamps of this type can be made of sufficiently high candle-power to meet all the requirements of head-lamp projection and seem destined to supplant other sources of light for this purpose.

Performance of Incandescent Head-Lamps

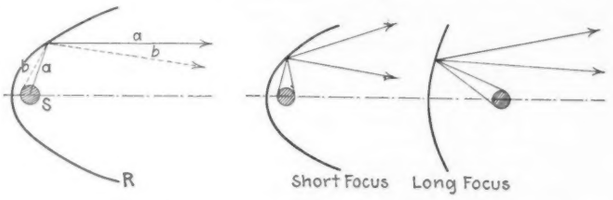
By L. C. Porter

Increasing public interest shown in the question of locomotive operation has brought about legislation on the head-lamp question in several states. In others the matter is pending. Naturally, this condition has resulted in considerable development and study, both on the part of the railroads themselves and also on that of the head-lamp manufacturers. A short account of technical questions involved in the production of a head-lamp, and some of the recent developments, may be of value in bringing about intelligent and effective legislation on the subject.

The principal light sources now available for head-lamps are oil flames, acetylene-gas flames, incandescent electric lamps and electric-arc lamps. The light emitted by any one of these, to be effective for head-lamp service, must be concentrated into a beam. There are two principal methods of accomplishing this—one by the use of a lens, the other by the use of a parabolic reflector. In either case to obtain good results the light source must be fairly well concentrated at the focal point of the lens or reflector.

Assume, for example, that each "ray" of light emanating from a light source is of 50-cp intensity. If one of these "rays" be re-directed so as to coincide with another, the result will be 100 cp. As there are a vast number of 50-cp rays emanating from a 50-cp light source, by re-directing a sufficient number of them a beam of many times the intensity of the original light source would be obtained. The more nearly these rays approach coincidence, the more powerful will be the beam. Consider, for example, a spherical light source *S* of Fig. 2, having its center at the focus of a parabolic reflector. A ray of light *a* emanating from the center of *S* will be reflected parallel to the axis of the reflector; a ray *b* emanating at the surface of the sphere will be similarly bent upon reflection, thus diverging. The further away from the focus the light originates, the greater will be the scattering; hence the less powerful the beam.

The focal length of the parabolic reflector influences the



FIGS. 2 AND 3—PARABOLIC REFLECTORS OF DIFFERENT FOCAL LENGTHS

spread of the beam. Assuming the same diameter of light source, it is evident that the angle between the two extreme rays which determine the spread of the beam (the angle of incidence being equal to that of reflection) will be greater in a short focus reflector than in a long one (Fig. 3). The curves of Fig. 4 show the relation between diameter of light source in sixteenths of an inch, focal length of reflector in inches, and spread of resultant beam in degrees.

As it is practically impossible to concentrate a powerful oil or gas flame into a small volume, these light sources are eliminated where a strong head-lamp is required. The electric arc is a very powerful light source of small volume. Backed by the proper reflector, it will produce an extremely powerful, dazzling beam. Many roads, especially the double-track ones equipped with block signals, consider such a beam detrimental to the safe operation of trains, owing to the temporary blinding of the engineer of an approaching locomotive, reflection from glass signal lenses, fog, etc.

Between the flame head-lamps (which are really only markers) and the other extreme comes the incandescent. The present high-efficiency drawn-wire tungsten can be formed into a lamp filament of high candle-power occupying a very small space. With such a light source backed by a good parabolic reflector excellent beams can be obtained—beams of sufficient intensity to enable an engineer to distinguish a man a thousand or more feet ahead of the locomotive, and having spread enough to cover a double-track roadbed, without throwing a powerful light onto the glass signals along the sides or over the roadbed. The accompanying table gives the feet of track covered by beams having various angular spreads at different distances ahead

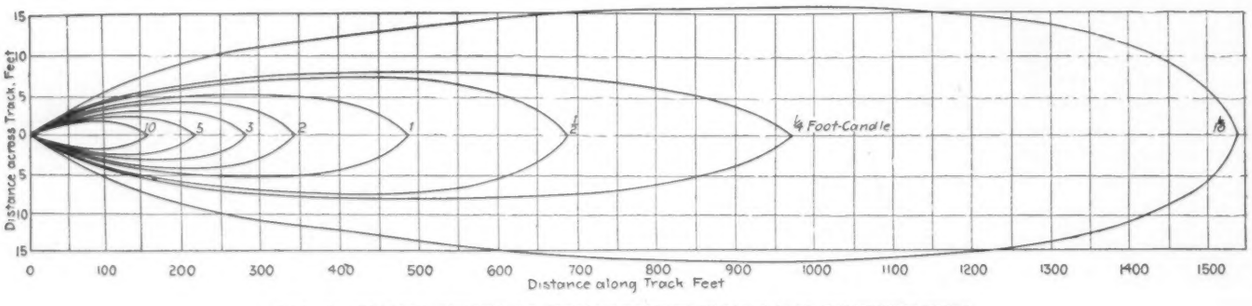


FIG. 1—ISOLUX CURVES OF INCANDESCENT HEAD-LAMP ILLUMINATION

of the locomotive. Fig. 5 is the distribution curve at 500 ft. taken across the beam thrown by a 6-volt, 50-cp concentrated filament tungsten lamp, backed by a 20-in. metal parabolic reflector of 2.75-in. focal length.

Fig. 1 shows the isolux curves of the beam shown in Fig. 5; that is, it shows the curves joining points of equal vertical illumination in a horizontal plane, passed through the

head-lamp.* In order to apply these easily to a railroad, the curves have been plotted as if laid off along a track, the length scale being ten times that of width. For example, every point on the 0.1-ft.-candle curve will be illuminated

ILLUMINATED AREA ALONG TRACK

Degrees Spread of Beam	Width of Track Covered, in Feet, at Different Distances from Headlamp									
	100	200	300	400	500	600	700	800	900	1000
1	1.75	3.50	5.25	7.00	8.75	10.50	12.25	14.00	15.75	17.50
2	3.50	7.00	10.50	14.00	17.50	21.00	24.50	28.00	31.50	35.00
3	5.25	10.50	15.75	21.00	26.25	31.50	36.75	42.00	47.25	52.50
4	7.00	14.00	21.00	28.00	35.00	42.00	49.00	56.00	63.00	70.00
5	8.75	17.50	26.25	35.00	43.75	52.50	61.25	70.00	78.75	87.50
6	10.50	21.00	31.50	42.00	52.50	63.00	73.50	84.00	94.50	105.00
7	12.25	24.50	36.75	49.00	61.25	73.50	85.75	98.00	110.25	122.50
8	14.00	28.00	12.00	56.00	70.00	84.00	98.00	112.00	126.00	140.00
9	15.75	31.50	17.25	63.00	78.75	94.50	110.25	126.00	141.75	157.50
10	17.50	35.00	52.50	70.00	87.50	105.00	122.50	140.00	157.50	175.00

to an intensity of 0.1 ft.-candle; every one on the 0.25 curve to 0.25 ft.-candle, etc. Therefore, every point in the area between these two curves will receive an illumination of not less than 0.1 nor more than 0.25 ft.-candle. Similarly with the other curves.

Tests by various railroads seem to indicate that it is necessary to throw an intensity of from 0.05 to 0.10 ft.-candle on a man in dark clothes to render him visible at from 800 ft. to 1000 ft. on a railroad track. It is seen that the 0.10 ft.-candle curve extends 1540 ft. ahead of and directly in front of the head-lamp—1000 ft. if 17 ft. to one side of the center of the beam, etc. Tests have also shown

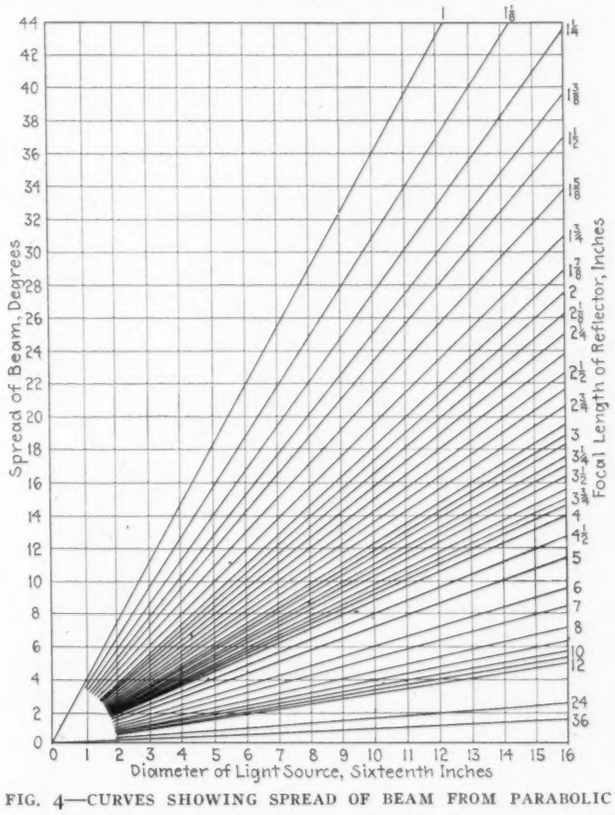


FIG. 4—CURVES SHOWING SPREAD OF BEAM FROM PARABOLIC REFLECTORS OF VARIOUS FOCAL LENGTHS EQUIPPED WITH VARIOUS-SIZED LIGHT SOURCES

that a man in white clothes can be discerned about one and six-tenths times as far down the track as one in gray, while the latter can be seen one and three-tenths times as far as a man in black.

*These curves are calculated from the candle-power distribution curve, on the assumption that the intensity of a head-lamp beam varies inversely as the square of the distance from the lamp to the point of measurement.

The braking distance of an express train running 60 miles per hour is in the neighborhood of from 1200 ft. to 1500 ft., depending upon various road conditions. Thus the incandescent head-lamp would show up obstructions in sufficient time to allow the engineer to reduce speed to such a point that the safety of the passengers would be assured.

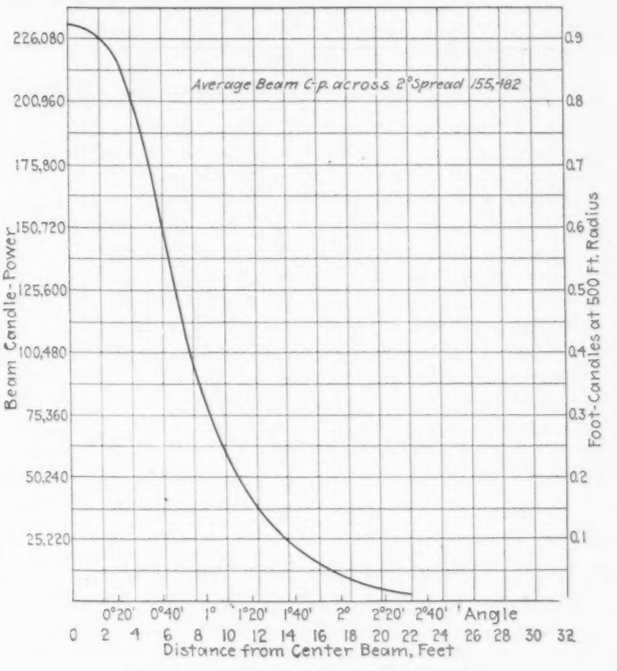

Average Beam C.p. across 2° Spread 155,482
Beam Candle-Power
Foot-Candles at 500 Ft. Radius
Angle
Distance from Center Beam, Feet

FIG. 5—CANDLE-POWER DISTRIBUTION

With the present location of the head-lamp on top of the boiler and the center of the beam trained on the track 1500 ft. ahead, the intensities on the track itself, close to the locomotive, would be somewhat lower than those shown in the isolux curves of Fig. 1. It would be an advantage if the head-lamps of locomotives could be mounted closer to the track. This would give better track illumination and less glare in the eyes of an approaching engine driver, and would make the classification lamps carried on the boiler more clearly visible.

There are under construction small 6-volt turbine generators of sufficient output to take care of head-lamps, cab-lamps and classification lamps, thus giving the locomotive a complete and independent lighting equipment. Recent improvements in the efficiencies of tungsten lamps seem to indicate that this lighting may also be accomplished by a relatively small storage battery.

Fort Wayne Ordinance Favors Electric Signs

In Fort Wayne, Ind., where the "city beautiful" movement has gained a strong foothold and is still being pushed by its adherents, an electric-sign ordinance has been passed which is aimed directly at unsightly advertising methods. The ordinance stipulates that nothing but electric signs shall be erected along the main thoroughfares. Such electrically illuminated signs must not be transparent, and they must have a minimum illumination of 2 cp per square foot of area. The latter clauses are added in order that the outline sign may be useful in reflecting light to the street where it is needed. The candle-power per unit area is specified so that a merchant may not erect a large canvas with a small lamp in the corner and call it an electric sign. Several attractive signs have recently been added to the circuits of the Fort Wayne & Northern Indiana Traction company.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Reduced Mortality Among Ozonized Chicks

Mr. F. Allen, a poultry man of Waltham, Mass., has been carrying on experiments, with the assistance of the Edison Electric Illuminating Company of Boston, in administering ozone to hatching and brooding chicks and has obtained some interesting and successful results. Ordinarily twenty-four to forty hours elapse from the time the first chick peeps forth from its shell until the last has appeared, but owing to the vigor imparted by the ozone a recent hatching came out in ten hours, and Mr. Allen, whose plant hatches 2000 chickens weekly, declares that this brood was uncommonly strong and robust. Experiments are now being extended to purifying the hen-poisoned ground of the brooders, in an attempt to save a portion of the 50 per cent mortality which occurs after the young chickens are hatched.

Neighborhood Merchandising

All large cities are usually made up of a number of neighborhoods, each with its social and business life. Recently there was held at Brownsville, the clothing manufacturing center of Brooklyn, N. Y., populated almost exclusively by Hebrews, an industrial exhibition. Here, under a large tent, occupying an entire block, were assembled a number of booths illustrating the industrial progress of Brownsville, and right alongside the display of the various classes of garment makers was the brilliant exhibit of the Edison Electric Illuminating Company of Brooklyn, which utilizes such affairs to get into personal touch with present and prospective customers and makes

EDISON BOOTH AT INDUSTRIAL EXHIBITION, BROOKLYN, N. Y.

a point of entering into the spirit of such occasions, in the same way as the local merchant does.

An attempt was made to show the public the right way to use various kinds of lamps, appliances and motors. For instance, a tailor's iron was rigged up complete with regulator stand, pilot switch and cord supporter; household appliances were demonstrated and various signs attached to an exhibit of tungsten lamps to show how much electricity is consumed by each lamp and what it costs to operate. Results showed that considerable interest had been aroused among prospective customers by the Edison exhibit. The first night six persons requested estimates for the wiring of their homes, four owners of tailoring shops applied for further demonstration of tailors' irons, and several inquiries were made concerning 500-watt tungsten lamps, one being for twenty-five, to be used in a large dance hall. There were also many inquiries about changes from carbon to tungsten lamps. This method of exhibiting at local affairs, bazars and other social gatherings seems to be a cheap and practical way of awakening public interest.

The tent in which the Brownsville exhibit was held was lighted with forty 500-watt tungsten lamps, which in itself was a big advertisement for electric light. Next to the Edison exhibit, shown in the accompanying illustration, was the booth of an electrical contractor, and further on was the display of a garment makers' union, which demonstrated that the best way to run sewing machines is with electric motors.

Electric Cooking at 1 Cent a Meal

In a Western city a rather extensive electric-cooking installation was put into service a few months ago in the local Y. M. C. A. cafeteria. Electricity is supplied from the central station. At the request of the electric-service company the manager of the association has given the following report of two months' operation:

"In the latter part of June, 1913, we installed a complete electric cooking equipment, consisting of Simplex stoves, ovens, etc., as follows: Two 17-in. ovens, two 8-in. stoves, two 10-in. stoves, two 12-in. stoves, one three-hole waffle-iron, one 12-in. by 18-in. hot-cake griddle, one 1-quart egg boiler, two toasters, one coil for 5-gal. coffee urn, and four 500-watt oven elements for hot table.

"The electric hot table was an experiment with us, but it is entirely satisfactory and very efficient. The hot table is divided into four compartments. Two are for meats and are 27 in. square with copper roll tops. Each oven has a false bottom 27 in. square and 3 in. deep in which is installed a flat 500-watt oven element. The air space is but little more than 1 cu. ft., and the electricity heats it perfectly. The remainder of the hot table is for vegetables and soups, each compartment being 27 in. square and about 7 in. deep. The containers are earthen crocks 12 in. in diameter and 7 in. deep, with a flange 2 in. from the top, allowing 5 in. of the lower part of the container to be in the oven.

"The meat ovens make very satisfactory plate warmers when not being otherwise used. With the exception of the toasters and egg boiler, all elements are installed with three-heat switches.

"During the first month, from July 1 to Aug. 1, we consumed 2120 kw-hr., from which should be deducted 120 kw-hr. used in preparing a banquet and also 96 kw-hr. for heating water for dish-washing when the hot-water plant in the building was out of commission, leaving 1904 kw-hr. at 3 cents per kw-hr., a total of $57.12. This was the total

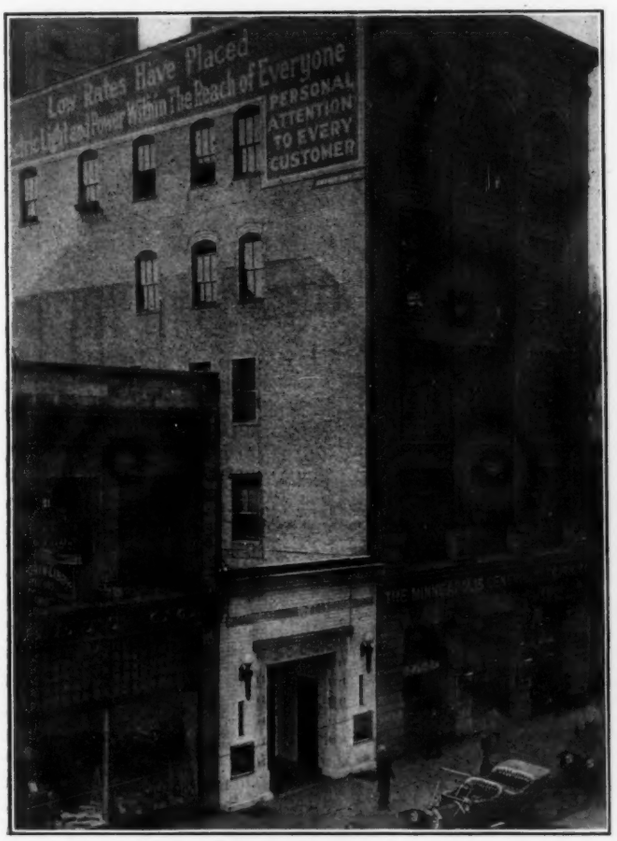
cost for preparing the food and keeping the hot table and a 5-gal. coffee urn hot for six hours each day. During the month of July we served 5220 meals, making an average cost of electricity for cooking slightly more than 1 cent per meal, or $1.13 per 100 meals.

"In August the energy consumed was 1964 kw-hr. at 3 cents, a total of $58.92. The number of meals served was 6271, or an average of only 94 cents per 100 meals. This reduction in cost per meal of nearly 17 per cent during the second month is due to the fact of our experience gained in knowing when and how to be economical. We feel that during each month we will show further slight reduction.

"While the cost of cooking by electricity may be slightly more than with wood or coal, the cleanliness and convenience of electricity, with the comfort and pleasure of a cool kitchen, more than compensate for any difference in cost."

"Personal Attention" Blazoned on the Outer Walls

Every effort is made by the Minneapolis General Electric Company to cultivate friendly relations with its customers and with the general public. Under the management of H. M. Byllesby & Company a policy of entire frankness has been adopted in dealing with the public. One of the company's mottoes is "Personal attention to every customer," and, as shown by the accompanying picture, the announcements of low rates and of personal attention are painted prominently on the walls of the company's office building. It is the intention to illuminate these signs later. The suggestion that the blank walls of the sides of the building be used for advertising is attributed to Mr. W. H. Hodge, publicity manager for the Byllesby organization. Electric sign and outline lighting is used on the front of the building.



PROMINENT "PERSONAL ATTENTION" SIGN ON OUTER WALL OF MINNEAPOLIS GENERAL ELECTRIC COMPANY'S BUILDING

Savings with Electric Trucks at Springfield, Mass.

Rapid expansion is under way in the commercial department of the United Electric Light Company, of Springfield, Mass., which serves one of the most representative communities in New England, from the cultural, business and manufacturing points of view. Within the past year the company has revolutionized its transportation service, and it now has a fleet of ten electric trucks in regular operation, ranging in size from 750 lb. to 5 tons capacity. The company's large stable has been transformed into an electric garage, and about a dozen horses have been displaced, besides the services of a number of stablemen.

A 5-ton machine is operated for cable pulling, and in the meter department two covered 1000-lb. Anderson electric vans have been installed. These cars are arranged for carrying meters and lamps and have a special floor covering of thick velour which provides an easy riding surface for the instruments. On the sides are boxes permitting quick selection of the sizes required for different installations. In a recent fifteen-month period one of these cars was run 9000 miles at a total cost of operation of 10 cents per mile, allowing for depreciation, current, license number and one set of tires. The cost of electricity for a day's run about town is about 3.7 cents per mile, figuring energy charge at 6 cents per kw-hr. In all its transportation work the company has saved about 30 per cent over former horse-traction costs. The meter wagons run at a speed of about 16 miles per hour.

Co-operating to Avert a Water Famine in Oklahoma City

During the latter part of August and the early part of September Oklahoma City experienced a serious lack of water. When the Canadian River, which is practically the only source of supply for the city, began to fail, owing to the continued drought, the usual quantity of 9,000,000 gal. a day pumped into the city mains was reduced to 2,000,000 gal. and the pressure was maintained in the residence districts for only one hour a day, at which time the citizens were obliged to procure all the water they needed for domestic purposes. This reduced service continued for about ten days, but the river showed no signs of rising. It then became imperative for the city officials to take some quick action to get water from some other source.

Apparently the most feasible plan was to draw upon the lake in Northeast Park, which, it was estimated, held enough water to supply the city for a period of from twenty to thirty days. The Oklahoma Gas & Electric Company, one of the Byllesby properties, has always been a public-spirited corporation. It noted with concern the serious effects of the drought, and a conference was held between the Mayor, the city commissioners and Manager W. R. Molinard of the company. Mr. Molinard offered to negotiate on behalf of the city with the Oklahoma Natural Gas Company for the loan of about 4 miles of 8-in. pipe, and he also offered to build an electric transmission line about 4 miles long to Northeast Lake to provide the energy for pumping. The central-station company also tendered the loan of the necessary material, provided the city would pay for the labor of construction and for the reclamation of such material as could not be afterward used by the company at its full value.

Mr. M. W. Walsh, superintendent of the gas department of the company, went to Tulsa, and the natural-gas company kindly offered to lend the necessary piping and fittings. Six carloads of piping were accordingly shipped from Tulsa to Oklahoma City, and by Sept. 8 two carloads had been unloaded and placed along the proposed line. Meanwhile work had been begun upon the electric trans-

mission. It was intended to use the poles of the street railway company as far as possible. But on Sept. 7 rain began falling in substantial amount, and by the morning of Sept. 9 it was determined to suspend operations until the result of the rains could be seen. The rains continued and encouraging reports were received from the upper waters of the North Canadian River, so that the city commissioners felt that it would, in all probability, be unnecessary to continue construction on the emergency line. By Sept. 18 nearly 3 in. of rain had fallen and the situation seemed to be relieved.

The promptness and public spirit with which the Oklahoma Gas & Electric Company and the other public-utility companies arranged to come to the assistance of the city were favorably commented upon by the press and the public.

The Story of Denver's 874 Electric Vehicles

Denver, Col., now has 822 electric pleasure cars and fifty-two electric trucks, evidence of the remarkable development which has followed the aggressive campaign of the Denver Gas & Electric Light Company. The latter's vehicle-charging ouput alone now totals 180,000 kw-hr. monthly, practically all of which is off-peak business with its demand coming between 10 p. m. and 8 a. m.

In order to introduce and popularize the electric vehicle, the Denver company several years ago created a special department of electric-vehicle and storage-battery engineering, with an expert engineer in charge. The first duty assigned to the engineer was to develop a higher class of service in existing garages, both public and private. He also set about establishing an educational scheme among the men of the company's commercial department by devoting a portion of each day to soliciting electric-vehicle "prospects" with the salesmen having charge of the various territories.

During this work personal calls were made on the owners of private garages, and instruction was given to those who desired it concerning methods of charging batteries and inspection of vehicles. Meanwhile particular attention was devoted to a campaign of solicitation directed at the officers and heads of firms and mercantile houses, with a view to interesting them in the adoption of electric vehicles for transporting and delivering goods. Different makes and types of vehicles were explained and data furnished as to cost, operating expenses, body designs, etc., of cars especially suited for the customers' purpose. In other words, the prospective user had placed entirely at his disposal the vehicle department's facilities for investigating motor delivery by means of electric-driven conveyances.

In addition to these direct selling efforts, the publicity department of the Denver Gas & Electric Light Company also issues an attractive monthly magazine, *The Electric Vehicle*. This sixteen-page bulletin is inclosed in colored covers and its contents are made up of interesting and authoritative reading matter concerning electric vehicles, both local and general. At intervals spaces in the newspapers are devoted to electric-truck advertising, and billboard displays are also used to good advantage in furthering the work of publicity.

Sixteen public garages, with a capacity for stabling 910 vehicles, are now in operation in Denver. For garaging, charging, washing and delivering electric pleasure cars the garage rates range from $25 to $35 per month. For trucks the rates vary from $30 to 90 per month, depending upon size. Among the local users of fleets of electric trucks are the Daniels & Fisher Stores Company and the American Express Company. These and other large customers seem pleased and satisfied with the service furnished by their electric trucks and have sent in orders for additional machines. The average rate received for vehicle charging in Denver is 3 cents per kw-hr.

Rates for Electric-Vehicle Charging

Presented herewith is a tabulation of the schedule of rates made by central stations in various cities for the charging of customers' electric-vehicle batteries. In some cases the concession made by the electric company requires that the customer avoid coming on the lines with his charging load during the peak period. Other central stations make no such restrictions, offering the special rate without limitations. Usually a minimum bill of $3 or $5 per month is collected to meet the readiness-to-serve cost of the heavy charging load, for in residential districts this often requires the installation of additional transformers and copper. The rates made for alternating-current and direct-current charging service are usually the same, the customer defraying the cost of the slight loss in conversion, through a mercury rectifier, motor-generator or rotary converter, in outlying districts where only alternating-current service is available.

CENTRAL-STATION RATES FOR VEHICLE CHARGING

City	Rate per Kw-hr., Cents
Schenectady, N. Y.	5
Augusta, Ga.	5
Turners Falls, Mass.	3
Columbus, Ohio	4
Long Island City, N. Y.	12
Cambridge, Mass.	5
Memphis, Tenn.	3
Brockton, Mass.	4–5
Portland, Ore.	4–1.5
Mobile, Ala.	4
Plattsburg, N. Y.	3
Worcester, Mass.	3
Montgomery, Ala.	1.5–2.5
New Bedford, Mass.	3.5
Meridian, Miss.	2–6
Denver, Col.	3

Sale of Electrical Supplies by Central Stations

By W. E. Robertson

Of the three general classes into which articles for sale may be divided—namely, necessities, conveniences and luxuries—electrical supplies can best be considered as belonging to the second. The methods followed in the sale of necessaries on the one hand and luxuries on the other present the extremes of economy and extravagance. We have nothing to do with either of these methods in the consideration of the sale of conveniences.

Every article of convenience is sold to take the place of some less efficient or less desirable article in use, or to meet some need not hitherto supplied. In every instance where a campaign to introduce a convenience has been successful the price of the article has been sufficiently low to make its use generally desirable, and yet sufficiently high to cover the cost of a long campaign of education and promotion, a campaign in which several times the price received for the first articles sold must be spent in creating the demand.

As practically everything that uses electricity is a convenience, and as with the introduction of all new conveniences there comes an educational campaign, the cost of which must be borne by future and not immediate profits, and as it is to the advantage of all companies selling electrical energy to encourage the widest diversity in the creation, manufacture and sale of convenient energy-consuming devices, and as the essential of all campaigns in the past to manufacture and sell conveniences has been the control of the re-sale price, I believe it follows, as a matter of logic, that the success of the central-station industry is to be found in the sale of electrical supplies on a commercial basis—that is to say, at a price which covers all of the elements of cost entering into the acquisition,

sale and delivery of the article plus a fair return on the capital invested.

The central stations, for the present at least and possibly for many years to come, should assist in creating a demand by advertising the use of all kinds of energy-consuming devices. They should aid the manufacturers by publishing the standard retail price of the goods advertised and thus supplement the efforts of the manufacturer in his campaign of national advertising. They should show the goods advertised in attractive display rooms and absolutely maintain the fixed prices of the manufacturer as the soundest possible permanent policy. This policy will create opportunity for dealers and contractors, and where opportunity exists men will be found to take advantage of it. The stimulation to the industry caused by having numbers of small stores in convenient locations for the display, sale and installation of electrical devices of all kinds, with the added impetus of individual ambition on the part of the owners of these stores, will many times effect the slight advantage now obtained by cut prices as an inducement to buy the device.

The writer is satisfied from a study of the field that the recent enormous increase in the sale of household devices is due to the national campaigns of advertising and publicity carried on by the manufacturers, and that the central-station advertising has had very little to do with this increase. Cut prices on the part of the central stations as an inducement to the consumer of energy to use electrical devices are as old as the central-station industry itself, and yet the development of the manufacture of these devices and the use of them by the public has been of remarkably slow growth. Suddenly a change has been brought about. Manufacturers of courage and ambition projected extensive and expensive national campaigns of education to create the demand at a fixed price for electrical devices, and the result has been the stimulation of the manufacture of all kinds of devices and an increase in business little short of marvelous. These campaigns have been of tremendous value not alone to the central stations in the sale of energy, but to all manufacturers of apparatus and supplies used to generate or convey their energy, and because of this demonstrated result it should be evident to the manufacturers, jobbers, contractors and central stations that the greatest welfare of the central-station interests in particular and the electrical industry as a whole is to be found in the sale of electrical devices and supplies at established manufacturers' prices and the constant discouragement of selling at cut prices.

While I believe that it is wrong for owners of commodities or dealers in them to boost prices artificially by agreements among themselves, yet I believe in the right of the creator of a device in the nature of a convenience to control absolutely the terms of the sale of it.

I can conceive of no possible harm being inflicted upon the people by not only permitting this, but by also punishing anyone who attempts to cut the price or interfere with the general prosperity of the creator of the article, and I can see a tremendous boon conferred on the people as a whole by permitting this absolute control of the resale price, in that it will furnish the greatest incentive to creative work, and our civilization will be rapidly or slowly developed as this idea is fostered or disregarded.

While the common law and later the statutes covering barter and sale were wise as applied to the times in which they were evolved, conditions have changed, and civilization is now more complex. An article is no longer a unit, but is an essential part of the great whole made up of millions of such units. The welfare of the manufacturers and of those connected with the industry is of infinitely more importance than property rights to the individual who buys something which is not necessary to the maintenance of his health, liberty or happiness, but is merely an addition to the number of conveniences which enhance his comfort.

Rural Lighting and Motor Service Near Noblesville, Ind.

The Noblesville Heat, Light & Power Company operating an 825-kw station at Noblesville, Ind., about 25 miles north of Indianapolis, the capital city of the Hoosier State, has been making strenuous efforts during the past year to secure rural customers for its circuits. The success which

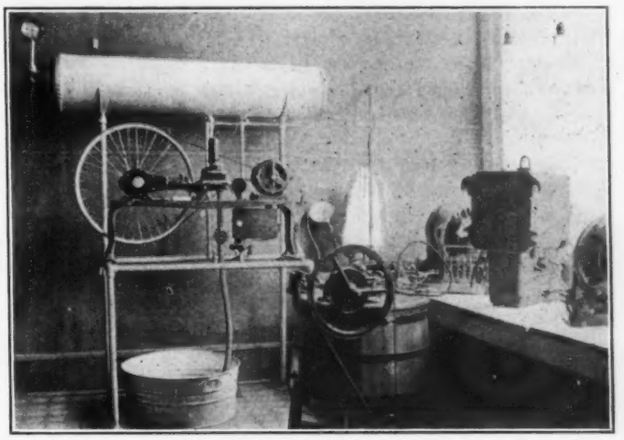


FIG. 1—WINDOW DISPLAY IN COMPANY'S OFFICE

has attended these efforts has been marked. One hundred strictly farm customers have been added to the company's list of patrons, in addition to a number of suburban homes not formerly reached and several neighboring small towns which have been supplied with electrical energy over the rural transmission lines.

The city of Noblesville had, according to the census of 1910 a population of 5073, while the surrounding towns which are supplied with energy from the local station are led by Lapel with 1045 inhabitants, Cicero and Arcadia having each 990 people, Westfield having 770 and Fishers

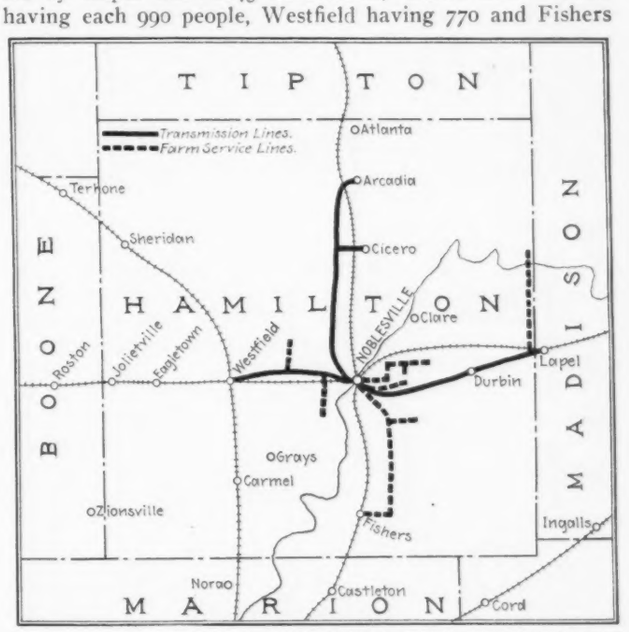


FIG. 2—MAP SHOWING TRANSMISSION LINES IN VICINITY OF NOBLESVILLE, IND.

188. In Lapel, Arcadia and Westfield electrical energy is also furnished from the Noblesville plant for street lighting. A local distributing company at Cicero buys the energy at wholesale from the Noblesville station and retails it to the inhabitants and to the city for street lighting. The transmission lines to these towns are shown on the map in Fig. 2.

All of the farm lines except that running 6 miles north from Lapel are operated at 2200 volts. The Lapel line carries 4400 volts. All service is single-phase. For the strictly farmer-service circuits the company estimates that at least four customers per mile must be obtained to make the line commercially profitable, and the following clauses quoted from the contract form set forth the terms under which these lines will be built:

"Application is hereby made to the Noblesville Heat, Light & Power Company by the undersigned for electric service for light and power on a line extending into the county and along the public highways in Hamilton and adjoining counties in Indiana, for a period of three years from date.

"The rate for service to be the same as prevails to customers in the towns, viz., 10 cents per kw-hr., subject to a discount of 5 per cent if paid on or before the fifth of the following month.

"The undersigned applicant agrees to use enough energy to make a quarterly bill of $1.50, or to pay that amount should sufficient energy not be used.

"The undersigned applicant further agrees to equip his premises to use electricity for such purposes as he may desire and pay for same, together with a transformer and wires from the main line of poles to his premises.

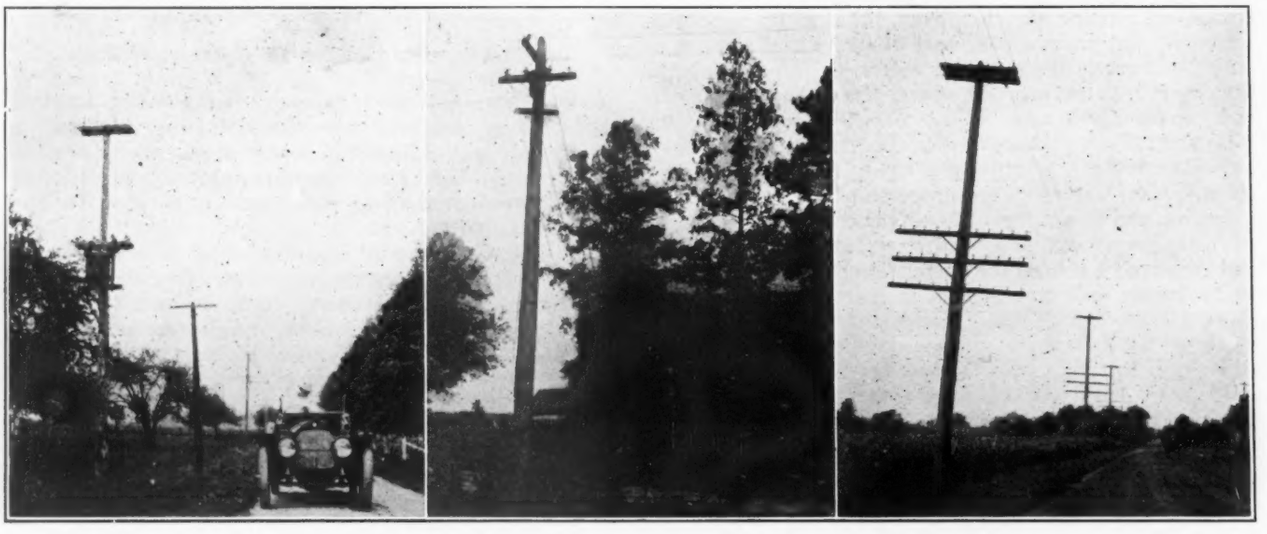
"The undersigned applicant further agrees to pay his proportional share of the cost of the main line in the public highway along his premises, with at least three other applicants per mile, provided the line does not exceed $200 per mile and with the understanding that the money thus paid for main line in public highway is to be refunded to said applicant in energy used at the above-mentioned rates.

"It is understood that the main line is to be owned, controlled and maintained by the Noblesville Heat, Light & Power Company, its successors or assigns.

"A written acceptance of this application by the Noblesville Heat, Light & Power Company shall make this a contract between the parties."

All lines built under this contract have been erected with standard two-pin arms on 25-ft. poles spaced at distances varying from 150 ft. to 225 ft., depending upon the kind of wire which was being strung. Where the load is light the 225-ft. spacing has been used to advantage, employing copper-clad steel wire for the conductor. Higher poles are used at road crossings and other places where the clearance demanded is more than can be given with a 25-ft. pole. Fig. 4 shows the type of construction used in these lines and also a three-wire house service which allows the farmer to operate his motors at 220 volts and have 110-volt service for the lighting. The transformer for the installation is mounted on the pole. The line shown in Fig. 3 is a combined transmission and farmer-service line and the type of construction here used is somewhat more sturdy than that seen in Fig. 4. Nearer the city, where it was possible by a contract with the telephone company to effect joint-pole construction, the combined transmission and farmer-service line is still more strongly built. Fig. 5 is a view of this joint line taken near the city limits of Noblesville.

Mr. John T. Kestner, who is contract agent of the Noblesville station and who has taken considerable personal interest in promoting the farm load, says that the central Indiana farmer is not so keen as he might be concerning the possibilities of motor service and that educational campaigns along this line are needed to stir up proper enthusiasm. However, the subject of electrically lighting the barn, when properly presented to the man who has always had to depend upon a smoking kerosene lantern for illuminating about 128,000 cu. ft. of space, which is a fair figure for an average barn, never fails to be a talking point, capable of holding attention and of creating that interest which speedily leads to the signing of a consumer's application.



FIGS. 3, 4 AND 5—TYPICAL FARM LINE AND JOINT LINE CONSTRUCTION AT NOBLESVILLE, IND.

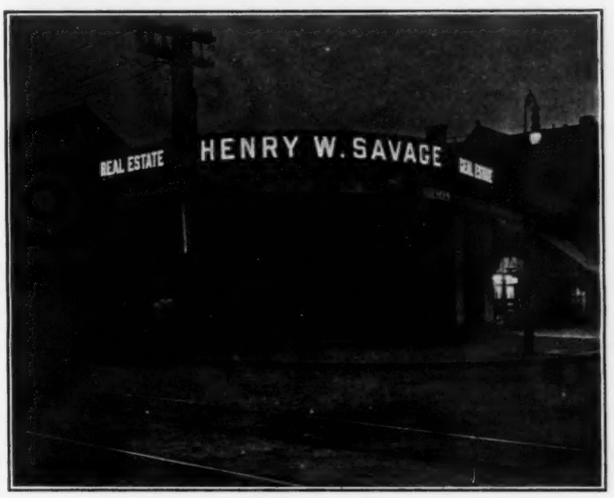
For interesting the rural population in the applications of motor service to ordinary farm labors, fitting window displays, such as the one shown in Fig. 1, are used from time to time in the company's office. The pumping installation in this picture is a home-made affair rigged up to show the ease with which a pressure-tank water system can be automatically maintained at constant pressure by means of a 1-hp motor connected to the service wires through a pressure limit relay. The pipe and hose connections have been arranged so that the water can be left to run into the tub and can be pumped out again into the pressure tank.

Meters on the rural lines are read quarterly by a lineman who drives over all of the lines. A lineman has been selected for this work for the reason that he can not only perform the duties of a meter reader but is able to make any needed repairs to the circuits and in many cases to remedy cases of trouble which require attention. All bills are paid at the office of the company in Noblesville either by mail or personal call. The central-station company employs two wiring gangs and keeps one busy on outside construction while the other attends to inside wiring both in the country and in the towns on the company's circuits.

Illumination and Wiring

Curved Electric Sign on a Suburban Real-Estate Office

The accompanying photograph shows an effective electric sign recently installed on top of a prominent real-estate office at Coolidge Corner, Brookline, Mass., facing an important electric-railway junction point and transfer station. In this installation the sign is arranged to attract attention on the north and east sides of the building as well as at intermediate points. It consists of two short straight sections and a curved section in the middle, giving a total length of 58 ft. over all and a width of 42 in. The electrical equipment consists of 306 5-watt, 11-volt tungsten



CURVED ELECTRIC SIGN

lamps supplied with alternating current through two transformers connected with the Boston Edison service. The lamps burn continuously from dusk until midnight, and the sign is installed about 15 ft. above the sidewalk. The letters are of the sunken type with gold-leaf trim and the sign cost about $240. On account of sharp competition in real estate in this portion of Greater Boston and the location of several offices of rival firms at this point, the sign illustrated herewith has been found to be a valuable factor in stimulating business. All outer Beacon Street and Harvard Avenue street cars pass this point on short headway service, and the adjoining streets are main highways of automobile traffic.

Errors in Photometry

In a paper read before the recent Pittsburgh meeting of the Illuminating Engineering Society by Messrs. Evan J. Edwards and Ward Harrison, Cleveland, reports were given on four separate investigations relating to the causes for error in photometric measurements.

The first investigation covered the relative accuracies of Bunsen and Lummer-Brodhun devices. This test, involving several thousand readings, showed the sensitivity, expressed in average deviation, to be 0.4 per cent for the Lummer-Brodhun as compared with 1.4 per cent for the Bunsen. The magnitude of error from parallelism of rays in the photometry of reflector sources was the subject of the second investigation. The results of tests on typical reflectors for general illumination purposes showed the errors in assuming the inverse square law to hold to be negligible.

For the third investigation the authors selected the adjustment error and the calibration of portable photometers. This method consisted in taking photometer readings for various distances from a working standard lamp and analyzing the results by reducing the relation to a straight-line function. The constant of the photometer was obtained from the slope and working standard intensity.

The fourth investigation related to errors in illumination measurements due to failure of the test plate to obey the cosine law. Discrepancies between the measured and calculated values of illumination were fully accounted for by this investigation. The average error of the plates investigated was found to be over 10 per cent at 45 deg. Computations show that the photometer results for an average installation are about 12 per cent low.

An interesting and valuable method of obtaining and recording candle-power distribution data was described by the author. A so-called thousand-lumen basis of drawing distribution curves was proposed, in order to avoid error and confusion in comparing reflector units. On this basis zonal lumen values are instantly convertible to percentage of the total, and the intensity values to percentage of the horizontal candle-power for the bare lamp. By using a single multiplying factor all values can be corrected to current lamp specific consumptions.

According to the method proposed, the polar candle-power curve is drawn on the basis of a lamp giving a total of 1000 lumens, which is very nearly correct for a 100-watt lamp operating at 1 watt per horizontal candle-power. Assuming the standard reduction factor of 78 per cent for the 100-watt straight-sides lamp, the total lumens at 1 watt per candle are 980, or 2 per cent less than the 1000 used. On the basis of a reduction factor of 81 per cent, which is standard for the larger round-bulb lamps, the total lumens for 1 watt per horizontal candle-power would be 1018. Therefore, the specific consumption is within 2 per cent of 1 watt per candle for both the straight-sides and round-bulb lamps on the basis of 10 lumens per watt, and the average happens to be within 0.1 per cent. It is seen that all values of lumens are instantly convertible to percentage of total. The intensity values are as easily converted into percentage of the horizontal for the bare lamp, with an error not greater than 2 per cent.

Among those taking part in the discussion were Messrs. W. R. Mott, Lakewood, Ohio; M. Luckiesh, Cleveland; S. L. E. Rose, Schenectady, N. Y.; L. J. Lewinson, New York; W. F. Little, New York; T. H. Amrine, Harrison, N. J.; Isador Ladoff, Pittsburgh; H. E. Ives, Philadelphia, and Evan J. Edwards, Cleveland.

In reply to the question of the other speakers, Mr. Edwards stated that the inverse-square law is applicable within reasonable errors even when projectors are photometered.

Store Lighting

In a paper read at the recent Pittsburgh convention of the Illuminating Engineering Society Messrs. Clarence L. Law and A. L. Powell reported the results of a study of the lighting equipment of various stores in New York City. Data were given concerning the dimensions, wall, ceiling and floor coverings, arrangement of fittings, type of glassware, number and sizes of lamps, and a general description of the appearance of each store. The data related to toy, toggery, millinery, candy, grocery, tea, shoe, curio, book, ladies' wear and stationery stores.

A sufficient number of installations were described to indicate quite clearly that the lighting system should blend with the general scheme of decoration. The authors stated that the satisfactory illuminating equipment is not dazzling, glaring or commonplace, but is inconspicuous and forms a part of the furnishing of the room. They claimed that one is able to apply commercial diffusers and reflecting devices to almost any class of service, and that there is no necessity

for the design of special auxiliaries. The authors remarked that in designing the lighting of shops of the better class discretion should be exercised in the selection of lighting units, and the prospective customer should not be offered something which is, on the face of it, purely utilitarian.

In discussing the paper, Mr. S. G. Hibben, Pittsburgh, remarked that glass can now be obtained to match decorative interiors, being made in various tints, such as old gold, green, amber, etc., and with etched monograms.

Mr. C. A. B. Halvorson, Jr., West Lynn, Mass., claimed that the arc lamp is well suited for certain interiors, such as large restaurants.

Mr. D. McF. Moore claimed that the vapor-tube lamps are excellent where distinctive lighting is desired.

In reply to a question by Mr. M. H. Flexner, Chicago, Mr. Powell said that cluster lamps are in favor because of the flexibility in the control of the illumination and the economy in operation when full brilliancy is not needed. Side-wall lamps are used in restaurants chiefly because ladies prefer an abundance of light on their faces in such places.

Quartz-Tube Lamps in Ornamental Lanterns for Decorative Illumination

At the Adams Street entrance of the present Continental and Commercial National Bank Building in Chicago, which will soon be the office headquarters of the Commonwealth Edison Company, four large and handsome street lanterns are attached to the side of the building by brackets, and project over the sidewalk. These lanterns are about 7 ft. high, and 3 ft. in diameter. They are of bronze, octagonal in shape, and are provided with panels of thick art glass nearly white in color. Tungsten lamps had been installed in these massive fixtures, but owing to the size and construction of the lanterns and the character of the ornamental glass the illumination was not particularly effective. Recently the incandescent lamps were supplanted by four Cooper Hewitt quartz-tube mercury-arc lamps, and the result is a striking and unique illumination. The lamps are of the same type as

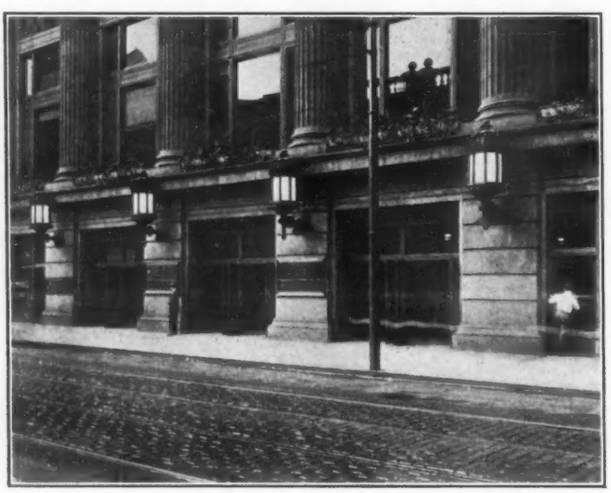


FIG. 1—LANTERNS AT BUILDING ENTRANCE WITH QUARTZ-TUBE LAMPS INSIDE

the six suspended by steel booms from building fronts on West Randolph Street, between North LaSalle Street and North Fifth Avenue, Chicago. They are operated on 220-volt Edison direct-current circuits, each lamp taking 726 watts. The lamps are installed about 15 ft. above the sidewalk. The color of the light is of the greenish tinge of the mercury-vapor lamp, but the effect is striking and the illumination is excellent. Fig. 1 is a daylight picture showing the fixtures, and Fig. 2 is a reproduction of an unretouched night photograph showing the effect

FIG. 2—NIGHT VIEW OF ILLUMINATION FROM QUARTZ-TUBE LANTERNS

of the illumination from the quartz-tube lamps in the fixtures on the left.

Church Lighting

Mr. Robert B. Ely, of the Philadelphia Electric Company, presented a paper at the Pittsburgh convention of the Illuminating Engineering Society, in which the various problems relating to the lighting of churches were discussed.

Concerning lighting systems the author stated that direct lighting, having been used to the greatest extent, still predominates. This fact is largely due to the architects, as they are more familiar with this method of lighting. There is a tendency, however, in favor of indirect lighting or a concealed direct-lighting system. The semi-indirect system has not been adopted to any extent, owing to the greater cost of translucent glass bowls and the greater installation costs.

Direct-lighting systems have been installed more generally, owing to lower installation and operating costs, the influence of the architect and the general public's lack of information on lighting matters. It is not at all unusual to see new buildings and churches equipped in a manner at variance with good practice simply because the architect's plans were drawn and the client had entire confidence in the architect. Generally architects will co-operate with the illuminating engineer, but this is not always the case.

There are some general rules that should be followed relative to the illumination of the church auditorium. No light sources should be within the line of vision. All lamps in any system of illumination should be hung sufficiently high, so they will not obstruct the view of those in the gallery of the church. No fixtures should be located so as to obstruct the architectural features. The intrinsic brilliancy of all light sources should be reduced, when visible from any point, by frosting or other diffusing media. Hymn boards should be illuminated by a concealed source where the general illumination is low or otherwise.

Generally in the construction of the chapel one or more side or roof windows are provided for daylight illumination of the chancel, thereby making this section of the church lighter by comparison than the main body of the

church. With artificial illumination this effect may often be obtained more readily and more effectively.

In formulating a plan or method of lighting the chancel or sanctuary the construction of the interior of the chancel will frequently demand special apparatus, reflectors and lamps, in order to obtain effective results. A chancel arch will greatly facilitate the installation of lamps and reflectors, but when there is no arch it is more difficult to place the lamps and reflectors to direct the light to the best advantage and avoid sharp shadows. Such equipment when placed at a great height should be so arranged that it can be lowered for renewal and cleaning purposes. But owing to the installation costs lighting units are more often located in a permanent manner behind the arch and renewals are made by the use of extension ladders.

The use of decorative altar illumination is increasing. Electric imitation candles are being used in many churches. The lighting of tabernacle niches as well as the outlining of altars is being done quite successfully by the use of low-voltage lamps. A sign-lighting transformer is often installed and receptacles are provided at various points on the altar, together with the permanent equipment, so that small electric bulb signs and emblems may be readily connected. The cost of such an installation is more or less offset by the low operating costs of the equipment.

On account of the tendency in recent years to increase the illumination in the body of the church it is necessary to increase the illumination in the sanctuary to make a noticeable difference in the intensity of the light in the two sections of the church.

The depth of some of the chancels is fairly great, and in order to increase the illumination on the altar or reredos it is necessary to concentrate the light from a source more or less localized.

The use of dimmers in the church is becoming more general. In some cases they are placed on the chancel and imitation candle standard circuits in Episcopal churches, and when the choir procession takes place the lamps are gradually brought to full brilliancy as the choir enters the chancel. In some of the Catholic churches dimmers are connected to the circuits of the church auditorium and sanctuary for use during special services.

The question of appropriate fixtures is an important one. The fixture designer has been studying ornaments for years, and this knowledge of ornament is of equal importance to the illuminating engineer, as he is not only called upon to plan the outlets for a lighting scheme but he often is obliged to select the fixtures. In the case of some of the more novel schemes of illumination, he is obliged to design fixtures to meet unusual conditions. This means that he must be familiar with the fundamentals and the different orders of architectural design. The illuminating engineer must study harmony of design, and particularly the effect of light and shadow on architectural ornaments.

There have been many apparent reasons given for copying ancient lamps and light sources to harmonize with certain styles of architecture. In carrying out such designs of fixture and lighting units, the units have frequently been so placed as to be distressing if not harmful to the eyes. Therefore novel and unusual methods may be inaugurated in designing the illumination for the church with due regard for ritualistic symbolism.

When the illuminating engineer attempts to effect new and unusual methods of lighting churches he should of course be familiar with the orders of architecture and ornament, so that he will be able so to design the lighting installation that some of the architectural features of the building may be brought out by light and shadow without distorting their appearance.

The candle is used in the services of the Roman Catholic Episcopal (high), Lutheran and German Lutheran churches. It has more prominence in the ceremonies of the Roman Catholic church than in the others.

In the Catholic churches the altar is the main feature to be considered for its symbolic significance, as the rubric of the church requires the use of wax candles for the various services. However, in numerous instances some of the candles that are still in use can be replaced by either gas or electric imitation candles to greater advantage, and this will result in a more effective appearance.

The lighting specialist should know when and how candles are used in religious services, their advantages and disadvantages. The mellow glow of the candle with the low intrinsic brilliancy of its flame is pleasing aside from the flicker—although there probably is an open question as to whether the flickering of the candles used for religious purposes is a distracting feature, or whether the light is more effective that way. There are certain times, particularly on holy and feast days, when the altar is illuminated to a greater extent than for ordinary services.

The author contended that from every standpoint good illumination is just as important in the church as it is in the place of amusement. Emphasis is laid upon the comparative methods employed by places of amusement and churches in the matter of making their audiences comfortable, because there is a very real analogy, which is too apt to be overlooked. There is nothing in religion which teaches that those who attend church services should be made uncomfortable, and yet lack of forethought upon the part of those responsible too often makes attendance at church services a positive source of distress for those whose eyes are not strong or are perhaps overstrained.

Discussion

Mr. Joseph D. Israel, Philadelphia, remarked that the purely business features of church-lighting work can best be handled by persons experienced in this line in order not to detract from the sacredness of the subject.

Mr. J. R. Cravath, Chicago, directed attention to the helical filament tubular lamps which are particularly advantageous in cove lighting. In illuminating paintings on ceiling decorations, it is essential to advance the light source so as not to be in the line of vision.

Mr. A. L. Powell, East Orange, N. J., remarked that certain simple designs of opal-glass bowls have been developed to harmonize excellently with church architecture.

Mr. S. L. E. Rose, Schenectady, N. Y., suggested the use of incandescent lamps equipped with parabolic reflection for lighting the gilded cross on the church steeple to obviate the need of a steeplejack.

Mr. R. F. Pierce, Gloucester, N. J., claimed that either the direct or the indirect lighting system will give satisfactory results in a church, provided each is properly installed and the simple brightness is kept at a low value.

Letter to the Editors

Associated Austrian Technical Societies

To the Editors of the Electrical World:

SIRS:—In connection with the proposed Association of American Engineering Societies, mentioned in your issue dated July 5, 1913, attention should be called to the General Congress of Austrian Technical Societies, which meets at five-year intervals. A committee is appointed at each meeting to conduct the business for the congress until it meets again. This committee consists of one delegate from each society, of which there are now forty-nine, and twelve members selected by the congress as a whole.

At the sixth congress, which met in December, 1911, the following twelve members were elected: Dr. von Bergen, president; Professor Lorber, vice-president; Dr. Dompieri and Messrs. Fellner, Goldemund, Günther, Höller, Kapaun, Klandy, Manthner, Mayreder and Singer.

Trieste, Austria. DR. GINO DOMPIERI.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Canal Gang's Cable-Pulling Record

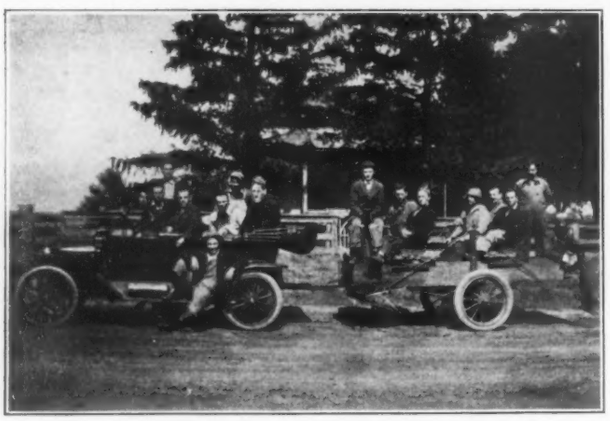
The cable gang working at the Gatun Locks, Panama Canal, under the direction of Supervisor G. A. Balling, recently established a local record for cable pulling. In one eight-hour day they drew 9828 ft. of eight-conductor, No. 10 lead-covered cable and 12,300 ft. of five-conductor, No. 10 lead-covered cable, a total of 22,128 ft. A total of 9200 ft. of cable was pulled during the first three hours. It rained the entire day, and on this account the conditions under which the work was carried on were unfavorable. The best Canal Zone record for any one month was made at Gatun Locks when 113,002 ft. of cable was pulled.

Gasoline as an Aid in Digging Holes in Frozen Ground

In northern Minnesota, where the earth freezes to a depth of from 4 ft. to 5 ft. in winter and where consequently the cost of digging holes is high, the following expedient is used to keep down costs. When the top of the hole has been picked out to a depth of 6 in. or more a tin cup full of gasoline or coal-oil is poured into the hole and lighted. The digging is then continued, the burning oil thawing the earth, and from time to time more oil is added. It is said that with the help of about a gallon of oil per hole the cost of digging can be reduced approximately 15 per cent.

Automobile Trailers for Line-Construction Crews

The accompanying illustration shows the automobile and trailer truck used by the line crew of the Central Illinois Lighting Company, which is now building a transmission line between Farmington and Peoria, Ill. The outfit has a capacity for hauling fifteen men at a speed of from 25 to 30 miles per hour. In this way the crew is taken out to the job in the morning and returned in the evening. When the distance from the site of the work back to Farmington is less than 12 miles the gang rides in for dinner.

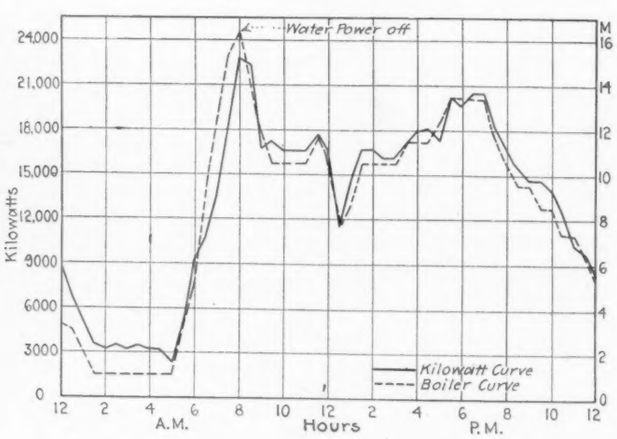


AUTOMOBILE AND TRAILER CARRYING LINE GANG

Similar use of automobile trailers is made by the properties of the Amesbury (Mass.) Electric Light Company, as recently mentioned in these columns. Each district of the system is equipped with a Ford runabout and a 1200-lb. trailer carried on roller bearings. The combination outfit is used in taking the line gang and its tools to each job in the morning, after which the superintendent uncouples the trailer, leaving it with the men as an outdoor shop. He then visits customers in trouble or needing the company's attention and returns at noon to take the men home for dinner, again attaching the trailer. The program is repeated in the afternoon. The combination equipment, loaded, will make a speed of 15 miles per hour on the road. The cost of operating one of these cars over 30,000 miles since November, 1911, has averaged 5 cents per mile, including gasoline, oil, repairs and sinking fund on the car.

Boiler-Room Record Comparing Steam and Energy Outputs

Shown herewith is a copy of the boiler-room record kept by The Milwaukee Electric Railway & Light Company for the purpose of comparing the steam produced with the electrical energy generated. It provides a ready means of ascertaining whether the firemen are operating the boilers at their most efficient rating and whether the steam piping is in proper condition. The steam curve is plotted in boiler-hp, and the electrical energy curve is plotted in kilowatts. As a standard from which to work the operating engineer is instructed to produce a certain number of kilowatts per rated boiler-hp or an equivalent higher number of kilowatts per boiler-hp, figured at the most efficient operating point. With definite figures from which to work and with a record like the one shown it is a simple matter for the superintendent of power plants to find out whether instructions are being followed. The boiler-hp is estimated from steam-flow meters installed in the stations. The reason for the steam curve being below the electric curve at one time and above at another is that the water-power plant operated in conjunction with the steam station at which this record was taken was in operation only part of the time. Where such auxiliary power was not used the steam curve falls above the electric curve.



COMPARATIVE STEAM-PRODUCTION AND KW-HR. LOAD CURVE

Comparative Costs of Motive Power in Ice Manufacturing

At the recent International Congress of Refrigeration in Chicago Messrs. R. H. Tait and L. C. Nordmeyer, of St. Louis, presented a paper on "Comparative Installation and Operating Cost of a Combined Ice-Manufacturing and Cold-Storage Plant" in which they compared the costs of (1) a simple steam plant, (2) a compound condensing steam plant and (3) a Diesel-engine and electric-auxiliary plant. It is assumed that the plant would be located in the Southwest and be capable of developing the equivalent of 72 tons of ice-making capacity for twenty-four hours daily. The yearly work is equivalent to 14,880 tons of ice. The cost of fuel oil is figured at 95 cents per barrel of 42 gal. The present price of fuel oil is greater than this, but not enough to make the oil engine a poor investment. Oil is burned under the boilers of the steam plants.

The estimates of the authors show the greatest economy for the oil-engine-electric plant. The equipment consists of two 225-hp Diesel engines, each belted to a 60-ton refrigerating machine and a 40-kw generator. All auxiliaries in the plant are driven by electric motors. Depreciation on oil engines is figured at 10 per cent for oil engines and 5 per cent for other machinery.

After giving estimates in some detail for the three types of plants, the authors summarize the comparative costs of installation and operation in the accompanying table.

COMPARATIVE COSTS OF ICE-MAKING PLANTS

	Simple Steam Plant	Compound Condensing Steam Plant	Diesel-Engine Plant
Cost buildings	$60,000.00	$60,000.00	$60,000.00
Cost machinery	65,000.00	76,400.00	83,923.00
Total cost	$125,000.00	$136,400.00	$143,923.00
Cost water per ton ice	.....	.....	$0.090
Cost fuel per ton ice	$0.976	$0.753	0.226
Fixed charges machinery	0.546	0.642	0.821
Operating cost	0.579	0.579	0.516
Cost per ton ice (no building charge)	$2.101	$1.974	$1.653
Building charge per ton ice	0.504	0.504	0.504
Cost per ton ice with building charge	$2.605	$2.478	$2.157

Comparisons deduced by Messrs. Tait and Nordmeyer are as follows:

Simple Versus Compound Steam Plant.—The compound condensing steam plant costs $11,400 more than the simple steam plant, but a saving of 12.7 cents per ton of ice is accomplished, which for 14,880 tons of ice-making capacity per year amounts to $1,889.76 per year. On this basis the compound condensing steam plant will pay for the difference in cost between it and the simple plant in approximately six years.

Simple Steam Plant Versus Diesel-Engine Plant.—The Diesel-engine plant will cost $18,923 more than the simple steam plant, but a saving is accomplished of 44.8 cents per ton of ice, or $6,666.24 per year. On this basis the Diesel-engine plant will pay for the difference in cost between it and the simple steam plant in less than three years.

Compound Condensing Plant Versus Diesel Plant.—The Diesel-engine plant costs $7,523 more than the compound condensing steam plant, but a saving of 32.1 cents per ton of ice is accomplished, which amounts to $4,776.50 per year. The Diesel-engine plant will pay for the difference in cost between it and the compound condensing steam plant in less than two years' time.

"From the comparison given above," say the authors, "it seems apparent that the oil-engine plant would be an exceedingly good investment. This should especially be apparent on account of the manner in which the deductions were made. The steam-driven plants received the benefit of the best efficiency that could be obtained—namely, a boiler efficiency in the case of the simple plant of 65 per cent, and in the case of the compound condensing steam plant, with the use of an economizer, of 71½ per cent.

"The steam consumption of the simple engine of the refrigerating machine was assumed to be 27 lb. per indicated hp-hr., while that of the electrical generators was assumed to be 30 lb. of steam per indicated hp-hr.

"In the case of the compound condensing steam plant, a steam consumption of 18 lb. per indicated hp-hr. for the steam engines of the refrigerating machine and 20 lb. per indicated hp-hr. was assumed for the generator engines, including steam for vacuum pumps and other auxiliaries.

"In the oil-engine plant the engines were credited with a low efficiency of 8 gal. per 100 boiler-hp-hr., while we have found that the fuel consumption of engines installed in the Southwest by the Busch-Sulzer Brothers-Diesel Engine Company was approximately 6½ gal. per 100 boiler-hp-hr. under normal working conditions. In addition to this, the oil-engine plant is charged with water bought from the city, as against artesian well water used in the steam plant.

"A further advantage is given to the steam installation by charging it with a depreciation and obsolescence of only 5 per cent, as against 10 per cent charged to the Diesel oil-engine installation."

Changing Two-Phase Generators for Three-Phase Operation

Following the recent merger of the Merchants' Heat & Light Company with the People's Light & Heat Company at Indianapolis, Ind., parallel operation of the stations of

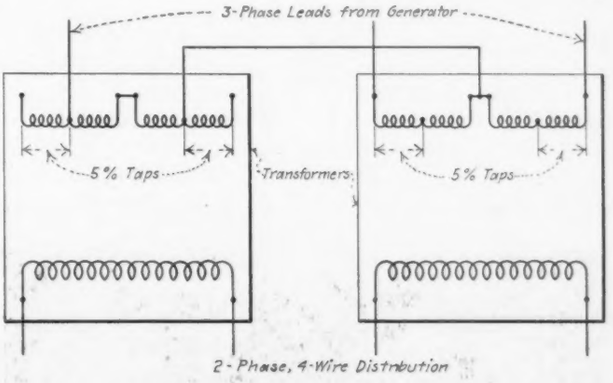


FIG. 1—CONNECTED TRANSFORMERS

the two companies became desirable. However, all of the equipment of the first-named plant was designed for three-phase operation, while the latter had a two-phase, four-wire system, the generating apparatus consisting of three two-phase alternators totaling 850 kw. In order to operate the two plants in parallel one of the larger units of the People's plant, a 300-kw alternator, was T-connected. The scheme used for making the connections is shown in the accompanying drawings. The terminal of one winding was first connected to the middle point of the other; then a tap was taken out at a point representing 86.66 per cent of the full length of the first phase coil. One lead from the four-wire machine was then discarded and the remaining three wires, being connected as shown, were used as the conductors for the three-phase energy.

The attendant transformer difficulties arising were overcome by an ingenious arrangement of connections shown in Fig. 1. The 5 per cent taps which are to be seen in the drawing were omitted from the leg of the T, which is commonly made 86.66 per cent of the full leg, making the actual

relation 90 per cent to 100 per cent. This proportion has proved to be sufficiently near the theoretical values for practical purposes, and on the trial run the machine readily came into synchronism with the remainder of the system and carried its full rated load without showing any signs of undue heating. The machine which has been

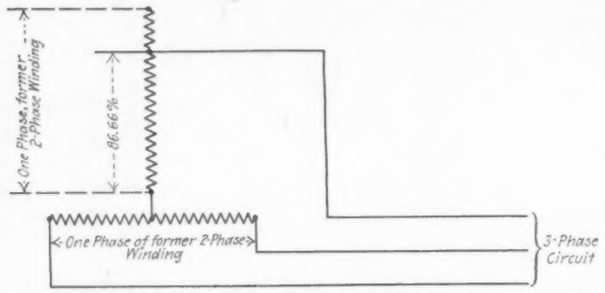


FIG. 2—DIAGRAM OF REARRANGED GENERATOR CONNECTIONS

changed is rated at 300 kw, 2200 volts, 60 cycles, and operates at 240 r.p.m.

Automatic Electric Water Works at Farmington, Mich.

The automatic electrically operated pumping plant which furnishes both the water supply and fire protection for Farmington, Mich., a typical village in a farming community, was described by Mr. A. R. Cary, of the Eastern Michigan Edison Company, before the recent convention of the Michigan Section, N. E. L. A. The equipment employed is of a type especially suitable for service to villages and small towns and was installed by the Dayton Pump & Manufacturing Company in 1912.

Water is obtained from two wells 170 ft. deep, one being 3.5 in. in diameter and the other 8 in. in diameter. From the large well the supply is pumped into a cistern or reservoir under the pump-house, while from the smaller bore the water is delivered directly into a pressure system. A pressure tank with a capacity of 13,000 gal. is used, although as normally operated the supply held in the tank is only 10,000 gal. or less.

The pumping equipment installed consists of: (1) a 5-hp,

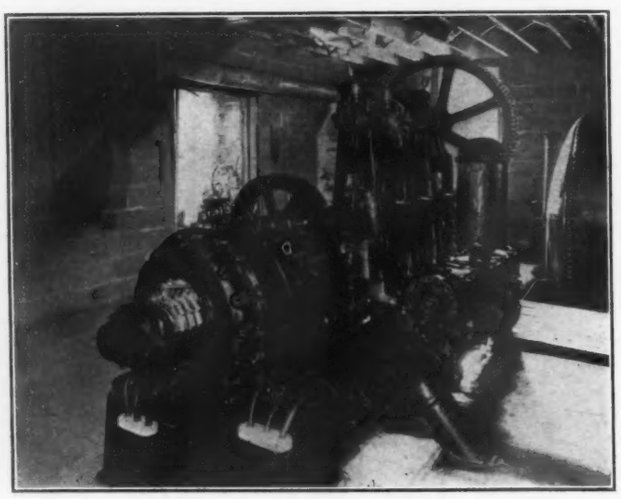


FIG. 1—FIRE PUMP, WATER WORKS AT FARMINGTON, MICH.

220-volt, three-phase Wagner motor running at 1140 r.p.m., which drives through gears a Dayton deep-well pump operating from the smaller well, at 45 strokes per minute, with a 12-in. stroke; (2) a 7.5-hp, 220-volt, three-phase Wagner motor running at 1720 r.p.m., which drives through gears a Dayton deep-well pump operating from the larger well at 46 strokes per minute; (3) an air-compressor driven through gears by a 3-hp, 220-volt, three-phase Wagner motor running at 1720 r.p.m. and discharging into the pressure tank, and (4) a triplex, single-acting, geared fire pump driven by a 30-hp, 220-volt, three-phase Westinghouse motor with a wire-wound rotor and slip-rings, which runs at 860 r.p.m.

The small pump delivers continuously into the pressure system. If the pressure drops below 30 lb., the fire pump is automatically put into service and pumps from the cistern into the pressure system. If the water level in the cistern falls below a certain point, the pump working from the larger well is "cut in" and fills the cistern. When the use of water is small and the pressure is right the smaller pump is also automatically put out of service.

No operator is needed in a plant of this kind. The village employs a man for a small sum to inspect the equipment and keep it oiled and in repair, which he can do in about one hour per day. The labor cost for operation is therefore negligible. As there is no meter on the water supplied, it is impossible to give any cost for the water pumped. The monthly bills for electric service, at 4 cents

FIG. 2—DEEP-WELL PUMP, WATER-WORKS AT FARMINGTON, MICH.

per kw-hr. (less 5 per cent for prompt payment), have run as follows: $40.77, $40.33, $36.18, $31.77, $32.42, $39.94, $48.34, $48.37, etc.

All water is paid for by meter. There are forty-eight consumers at present, but many more are being added. The minimum charge of $1.50 per quarter allows the consumer to use 9000 gal. When more water than this is used, there is a charge of 15 cents per 1000 gal. for the next 10,000 gal., and a charge of 10 cents for all over 19,000 gal. used.

Energy supply to operate this installation is received from Detroit over a 4600-volt, three-phase line. This pressure is then stepped down to 230 volts by a 30-kva General Electric transformer located about 50 ft. from the building.

A generally similar pumping plant, to cost $14,000, is being installed in a small town near the center of the State, and three others are soon to go in.

Load-Factor of Hydroelectric Plants

What is the load-factor of the best hydroelectric plants? F. N.

The combined output of the Niagara Falls Power Company and the Canadian Niagara Falls Power Company is over 868,000,000 kw-hr. a year and the load-factor is over 82 per cent. This is the largest and most satisfactory hydroelectric development from all viewpoints that we know of.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Polyphase Series Motor.—J. Jonas.—An article illustrated by diagrams on methods of phase compensation and methods of insuring the stability of operation of polyphase series motors. The author discusses methods based on variation of the winding ratio and shows that neither special choice of the winding ratio nor the saturation of the series transformer insures stability over the whole speed range, but that this can be attained by the use of additional resistance in the motor circuit. The combination of these three methods is advantageous.—*Elek. Zeit.*, Sept. 18, 1913.

Standardization Rules of Dynamo-Electric Machinery.—Revised standardization rules for rating and testing electric machines and transformers were adopted at the last meeting of the German Association of Electrical Engineers and will be in force after July 1, 1914. These regulations contain definitions, rules on the testing of dynamo-electric machinery, commutation, temperature increase, overloading, insulation, methods of determining efficiency, and voltage drop.—*Elek. Zeit.*, Sept. 4, 1913.

Direction of Rotation of Vectors.—Fritz Emde.—A letter taking exception to the arguments given by Breisig and Wagner in favor of rotation to the left of alternating-current vectors.—*Elek. Zeit.*, Sept. 11, 1913.

Lamps and Lighting

Arc-Lamp Electrode.—A note on a recent British patent (No. 10,210, 1913) of J. Rondal. The electrode has high emissivity and is not easily oxidized when burned in an inclosed but not air-tight lamp. The carbon before or after pressing is impregnated with a mixture of sodium or potassium aluminum phosphate and graphite containing earthy admixtures. Preferably also baked calcium saccharate is added to the core.—London *Elec. Eng'ing*, Sept. 4, 1913.

Street Lighting in Dresden.—A. Strauss.—A translation in abstract of his article recently abstracted in the *Digest* and showing the gradual development of street lighting in the city of Dresden in Germany from carbon arc lamps to flame-arc lamps and more recently to tungsten incandescent lamps.—London *Electrician*, Sept. 5, 1913.

Generation, Transmission and Distribution

German-Swiss Water-Power Plant.—E. Frey and O. Albrecht.—The first part of a fully illustrated description of the new power development at Rheinfelden. It consists of two separate projects. One is the Wyhlen water-power plant of the Rheinfelden transmission system and the other is the Angst power plant of the city of Basle. The present article relates to the Wyhlen plant. In view of the time required to build the water-power development, a steam-turbine station of 10,000 hp rating with two turbo-generators was first erected. The water-power plant, which was finally opened last year, has ten main turbine units and two turbine-driven exciters. Each main unit is rated at 2200 hp. The article is to be concluded.—*Elek. Zeit.*, Sept. 11 and 18, 1913.

Victoria Falls Power Scheme in South Africa.—An editorial note referring to the fact that some years ago it was proposed to transmit energy from the Victoria Falls, on the Zambesi, to the Rand. A power house with a capacity of 30,000 hp was to be constructed as a beginning, and 12.5-cycle energy was to be transmitted over a three-phase aluminum line at a pressure of 150,000 volts. The beginning was made by buying up existing steam stations, and the latter plants have developed so well that the system now has an aggregate capacity of 230,000 hp, with 32 miles of transmission line over which supply is satisfactorily maintained. An additional 90,000 hp has been contracted for. According to the 1912 report of the directors, "as yet the company does not derive anything from the Falls except its name and the exclusive right to develop the power there. When the demand is large enough to justify the heavy outlay necessary in order to utilize the falls the company will exercise that right."—London *Electrician*, Sept. 19, 1913.

Traction

Wireless Train Control.—An illustrated account of a recent exhibition in England of the Prentice automatic system of wireless train control. The system includes: (a) an ordinary track-circuit arrangement whereby the presence of a train or vehicle in a section short-circuits a relay; (b) a high-frequency plant, the current from which is controlled by the track-circuit relay; (c) an insulated conductor known as the "wave wire," placed along the track to carry the high-frequency current; (d) an arrangement of antennas, known as a "harp," below the engine, whereby the energy from the "wave wire" is received on the locomotive; (e) a coherer and decohering device and relay in synchronism; (f) a "time-lag" relay for the time required for decoherence, whereby a continuous holding action is realized as long as the "wave wire" is energized; (g) a "master" relay, and (h) devices whereby the release of the "master" relay by the cessation of the high-frequency current causes the exhibition of a "danger" indication on the engine, application of the brakes and the sounding of an audible alarm. A wiring diagram of the connections is given and described in detail.—London *Electrician*, Aug. 29, 1913.

Installations, Systems and Appliances

Bremen.—The electric distribution problem of the German city of Bremen is rendered difficult by the many small houses, which necessitate a great cable length, and the large number of house installations for the number of customers (at present 9000 house installations for 11,000 customers). As long as only direct current at 2×115 volts was available the network was restricted to the interior city and to some of the better residence districts. But since a second power plant was erected in 1907 supplying three-phase alternating current the network has been extended over the whole city and to outlying villages. The transmission pressure is 7000 volts, while the distribution voltage is mostly 216 volts. Details are given of the transmission system, especially the construction of the transformer stations, the telephone system and the use of a portable testing station.—*Elek. Zeit.*, Sept. 18, 1913.

Electrophysics and Magnetism

Electromagnetic Waves.—K. W. Wagner.—An elementary treatment of electromagnetic waves. From Faraday's induction law and the law of the magnetic circuit it is shown how electric magnetic waves are produced and what laws they obey. From the consideration of the energy in a propagating wave the conception of the energy flux is

deduced. Finally, electromagnetic waves caused by closing switches, etc., are briefly discussed.—*Elek. Zeit.*, Sept. 11, 1913.

Lightning Flashes.—W. Kohlrausch.—A description of some peculiar lightning-flash observations which partly indicate a high skin effect of the lightning flash and partly seem absolutely inexplainable.—*Elek. Zeit.*, Sept. 18, 1913.

Columnar Ionization.—E. W. Wellisch and J. J. Woodrow.—An account of an investigation in which a method was devised to compare the ionization due to a single alpha particle when measured in a longitudinal and transverse field. The results confirm the view of Moulin and Langevin that the upward slope characteristic of the alpha-ray ionization curve when a longitudinal field is employed is due entirely to recombination of ions in the column. The suggestion of Wellisch and Bronson that the slope is due in part to ionization by collision is shown to be untenable. It is shown that Langevin's theory of recombination appears to be applicable to the ionization produced by a single alpha particle; also the theory enables an estimate of the mean cross-section of the column to be computed.—*Philos. Mag.*, September, 1913.

Disintegration of Uranium.—Alexander Fleck.—An account of an investigation in which the existence of a new radioactive disintegration product, uranium X_2, discovered by Fajans and Gohring, is confirmed. Its period of average life is one and six-tenths minutes and its period of half value is one and one-tenth minutes. The hard beta rays of uranium X come from uranium X_2 as found by Fajans and Gohring, and the soft beta rays come from uranium X_1. Hence uranium X_2 cannot be the parent of actinium.—*Philos. Mag.*, September, 1913.

Electrochemistry and Batteries

Electric Furnace Electrodes.—W. McA. Johnson and George N. Sieger.—The second article of a serial on electric furnaces, their design, characteristics and commercial applications. In the present instalment the authors give practical information concerning graphite and carbon electrodes, with features of design, installation and consumption.—*Metall. and Chem. Eng'ing*, October, 1913.

Electric Steel Refining.—Joh. Harden.—An account of a new electric steel refining plant in England, the induction furnace being used. Details of the design and cost of operation are given.—*Metall. and Chem. Eng'ing*, October, 1913.

Units, Measurements and Instruments

Dielectric Properties of Non-Conductors.—Phillips Thomas.—A Franklin Institute paper which describes and gives the results of tests upon the electrical properties of mica, paraffined paper, celluloid and ice. The materials were tested in the form of condensers, and the tests included measurements of the capacity, power-factor, conductivity, break-down strength and capacity variation with applied voltage. The tests covered a range of from 3000 cycles to 250 cycles per second by sine-forming alternating voltage and from 83 cycles to 1 cycle per second by unidirectional charges applied for equivalent times of charge. The results of the tests were reduced to values for unit dielectric volume, and a table of such results is included. It is shown that there is a general relation between the electrical properties of the materials tested—that is, that the substances with high dielectric constant have also high dielectric losses, low breakdown strength and low insulation resistance. Temperature effects were eliminated by making all measurements on each condenser at a constant temperature. As far as possible this temperature was made the same for different materials, so that a comparison of the results is not subject to temperature correction. It is shown that within ordinary commercial limits the capacity of condensers having either of these substances as dielectrics is independent of the magnitude of the voltage applied to them. The results of the tests are given in the form of curves.—*Journal Franklin Inst.*, September, 1913.

Measuring Magnetic Susceptibility.—W. H. F. Murdoch.—A paper read before Section G of the British association pointing out the advantages of the magnetometer method for measuring magnetic permeability and susceptibility, especially its directness and simplicity. In the cut S' is a long solenoid used to magnetize the specimen s', which is in the form of a wire situated in the magnetic axis of the solenoid. In series with this solenoid is a coil C, in the center of which is suspended a magnetized needle n, to

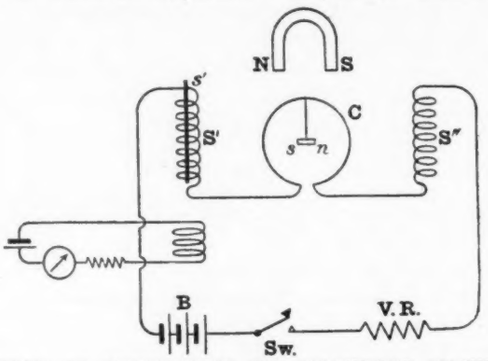


DIAGRAM OF CONNECTIONS FOR MEASURING MAGNETIC SUSCEPTIBILITY

which is attached a mirror or pointer; NS is a controlling magnet to neutralize the earth's horizontal intensity acting on the needle n and S'' is a solenoid suitably arranged to neutralize the magnetic effect of S' on the needle n. These solenoids and coil are joined in series with one another, and a battery B, variable resistance VR, switch, etc., are included in the circuit. A compensating coil to neutralize the earth's vertical intensity acting on the specimen may be wound over S', and this circuit includes a battery, resistance and current indicator. The needle n is adjusted so that when the earth's horizontal intensity is neutralized it comes to rest in any position about the center of the coil, and the magnetic action of any small current is sufficient to pull it into the zero position, which is perpendicular to the plane of the coil C. If now a piece of iron is inserted in the solenoid S' it acts on the needle n in such a way that it is attracted or repelled out of the zero position. The solenoids may be arranged in either the "A" or "B" position of Gauss, or unipolarly. The theory of the method is given, as are the results of its application to tests of an iron wire.—London *Electrician*, Sept. 19, 1913.

Meter.—An official announcement of the Reichsanstalt by which a meter with a double counting device of the Bergmann Electric Company is admitted for calibration. The construction is described and illustrated.—*Elek. Zeit.*, Aug. 28, 1913.

Experimental Alternating-Current Plant.—R. M. Archer.—An illustrated description of an experimental alternating-current plant for a British technical laboratory and of the switchboard specially designed in connection with it. The author urges that students should make their own connections.—London *Electrician*, Sept. 5, 1913.

Phase Meter.—K. Gruhn.—An illustrated description of a new electrodynamic phase meter of a German company. It is essentially a double wattmeter with one single movable current coil (connected to a measuring transformer). Four poles arranged symmetrically in a circle hold the voltage coils of the wattmeters. There result two fluxes to which by means of an induction coil there is given a certain desired phase difference. The commercial phase meter for 5 amp and 50 cycles has a voltage drop of 1 volt and consumes in the voltage coil 60 milliamp.—*Elek. Zeit.*, Aug. 28, 1913.

Photometers.—G. A. Shook.—A second article of his serial on quantitative spectrum analysis in which the author

describes several types of spectra photometers and discusses their advantages and disadvantages.—*Metall. and Chem. Eng'ing,* October, 1913.

Seismograph.—J. J. SHAW.—A note on a recent British association paper on new improvements in the seismograph. Hitherto it has been found that the free oscillation of the boom was a great disadvantage, and Continental European workers have endeavored to avoid the difficulty by employing a heavier boom. This, however, is unsatisfactory, since it reduces the sensitiveness of the instrument. The author's method consists in attaching a light aluminum disk to the end of the boom in such a manner that it can oscillate between the poles of four permanent magnets, and thus damping is effected by the induction of eddy currents in the disk. The device secures a damping effect of about 8 to 1.—London *Electrician,* Sept. 19, 1913.

Meter.—An official announcement of the Reichsanstalt admitting for calibration a polyphase induction meter of Landis and Gyr. The construction and operation are described, the connections are shown in diagrams, and rules to be followed for calibration are given.—*Elek. Zeit.,* Sept. 11, 1913.

Telegraphy, Telephony and Signals

Wireless Telegraphy.—G. W. O. HOWE.—A paper read before Section G of the British association on the nature of the electromagnetic waves employed in radio-telegraphy and the mode of their propagation. The author bases his discussion on power transmission over two wide strips of thin copper placed face to face and close together. After discussing the physical aspects of this problem he arrives at Poynting's theorem and lays the foundation for a discussion partly analytic and partly graphical of electromagnetic wave phenomena.—London *Electrician,* Sept. 19, 1913.

Wireless Telegraphy.—W. H. ECCLES.—A paper read before Section G of the British association. Mathematical analysis has shown that wireless-telegraph signals could not be transmitted a quarter way round the globe by means of diffraction. One assumption of this analysis is that the air is a perfect homogeneous dielectric. Against this the author states that the atmosphere is always and everywhere ionized to some extent and is almost certainly more ionized at high levels than at low. Heaviside pointed out that if strong ionization sets in suddenly at some high level, this layer would act as a reflecting envelope and make possible the propagation of waves to the antipodes. The hypothesis introduced by the author is based on the assumption that the sun's rays ionize the atmosphere in such a way that the concentration of ions increases gradually as we ascend in the atmosphere. On this basis the author gives a simple method of treating mathematically the problem of refraction of electric waves around the earth.—London *Electrician,* September, 1913.

Wireless Telegraphy.—H. MOSLER.—An account of an investigation extending over a year in which the receiving intensity of a station at a distance of 425 km (255 miles) was measured day and night. During the day the receiving intensity is not influenced by the height of the sun or, in other words, is constant during the whole year, but during the night there are characteristic maximum peaks in autumn and spring. The receiving intensity is particularly increased for short intervals in the night during the cold season, and this is thought to be due to changes in the ionization phenomena in the upper atmosphere. Effects of moonlight were not observed.—*Elek. Zeit.,* Aug. 28, 1913.

Wires, Wiring and Conduits

Pure Mathematics.—H. F. BAKER.—His presidential address to Section A of the British Association for the Advancement of Science. The address dealt with the proper place of pure mathematics in the scientific world.—London *Electrician,* Sept. 12, 1913.

Book Reviews

THE INSPECTOR AND THE TROUBLEMAN. By Stanley A. Edwards and A. E. Dobbs. Chicago, Ill.: Telephony Publishing Company. 196 pages, 86 illus. Price, $1.

This book is intended especially for practical telephone men working in small magneto exchanges. Included in the narrative of the instruction of a young troubleman by his superiors, the older linemen and the company's inspector, is to be found a great amount of information relating to the theory of electricity as applied to telephony. Line construction and maintenance, common and uncommon cases of trouble that occur on magneto exchange systems are discussed in a conversational style, so that in addition to furnishing diversion to the reader the story carries with it many facts and the solution of practical problems that cannot fail to be of interest to the man in the field and to prove of real value to him in showing the right way out of the difficulties of one kind and another that he is constantly meeting in his work.

SAFETY. Methods for Preventing Occupational and Other Accidents and Disease. By William H. Tolman, Ph.D., and Leonard B. Kendall. New York: Harper & Brothers. 422 pages, illus.

Comprehensive in scope, filled with practical information and valuable data, this volume will make a wide appeal. It is the first general exposition of the subject that has appeared in English. The statement of the authors that the annual number of accidents resulting fatally or in partial or total incapacity is 500,000, at an economic loss of $250,000,000 per annum, is rather startling, and emphasizes the need for specific information on safety measures and the great desirability of the conservation of human life. The contents of the volume are divided into four parts: general conditions, danger zones, industrial hygiene, and social welfare. The large amount of material covering many industries has been carefully edited. Safety measures adopted by various companies in the United States and abroad are discussed. The data will be found of much value to companies planning additional safety measures and welfare work, with all their far-reaching influence for good. The illustrations lend much of interest to the work, and the very complete index adds to its usefulness.

ILLINOIS PUBLIC UTILITY COMMISSION LAW AND MUNICIPAL OWNERSHIP LAW. By William J. Norton, M. E. Chicago: Published by the author. 200 pages. Price, $2.

Mr. Norton, who is secretary of the rate research committee of the National Electric Light Association and who was formerly first assistant secretary of the Public Service Commission for the First District of the State of New York, has done a real service to the privately owned utilities of Illinois and all students of the subject of the regulation of utilities by preparing this book. The new public utility commission law and the new municipal ownership law of Illinois are given in full from the official text as passed by the Legislature and signed by Governor Dunne last June. The book contains an index-digest which shows in a clear and comprehensive manner the powers of the commission, what the utilities must do, the proceedings before the courts, penalties, etc. In addition, the law is printed with marginal notes and with footnotes, the latter giving the source of the various provisions and occasionally making comment. The laws are printed on one side of the page only so that the other is available for notes. An alphabetical index is provided to supplement the analysis in the index-digest. A brief synopsis is also given of the provisions for the indeterminate permit in the law providing for the new Public Service Commission of Indiana.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Cement for Use at High Temperatures

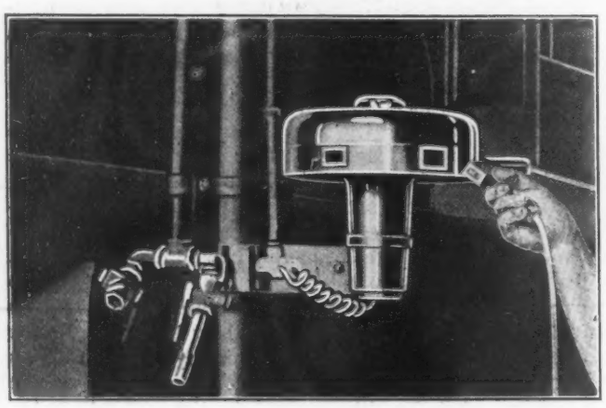
The H. W. Johns-Manville Company, New York, has recent brought out a new furnace product, known as "high-temperature cement No. 31," which it is said can be used successfully whenever working temperatures range between 1500 deg. and 3100 deg. Fahr. The new material is a dry powder mixture composed of asbestos and other ingredients of secret preparation. When being made ready for use it is mixed with water to the proper consistency (say, about 18 lb. to 20 lb. of water to 100 lb. of powder) for working like mortar or tamping around molds. Used for setting up firebrick for boilers and furnaces, lining and roofing furnaces of various kinds, molding into door jambs, lining fire doors, repairing side walls of furnaces, making stay-nut caps, etc., it has considerable mechanical strength. When air-dried, it will withstand a crushing strain of 883.5 lb. per sq. in. It vitrifies at the comparatively low temperature of 1418 deg. Fahr. and has a high melting point (3182 deg. Fahr.).

Being semi-acid in character, it can be used with chrome bricks, silica bricks or fire-clay bricks.

Revolving-Head Receptacle

Six receptacles and fuse blocks arranged on a pivot form what is called a "revolving-head receptacle" by its manufacturer, the Central Electric Company, Chicago, Ill. A set of conductors rings make connection to the receptacles so that the head may be revolved freely in any direction. Cover and base are of cast iron and are fastened together with wing-nuts.

Ordinarily the head is supported on a heavy cast-iron base fitted to the top of a 3-in. pipe forming a central stand from which energy for a number of lamps or other

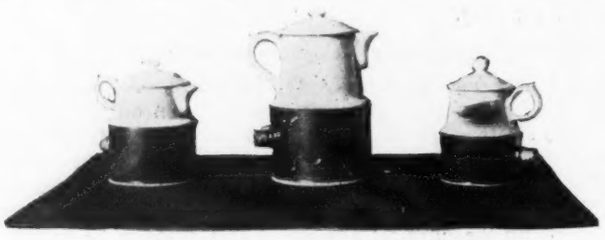


RECEPTACLES ON POST IN SHOP

devices may be taken. However, in the illustration herewith the head is shown fastened by a malleable-iron bracket to an upright post in a crowded shop. It is said that in shops where forgetful workmen are apt to leave their trouble lamps in cars or where traveling cranes are liable to become entangled in temporary wiring this revolving head is of great value, as it will allow the socket upon which the pull is being made to align itself so that the attachment plug will be drawn from its receptacle without damage.

English Earthenware Cooking Devices

The so-called "boiling pot" and "boiling jug" are made of earthenware with the heating element in the form of a closely fitting band attached to the outside surface. In the



EARTHENWARE COOKING DEVICES

devices shown the plug which is attached to the heating band is of a type not standard in the United States, but no doubt the manufacturers will meet this requirement if a sufficient demand arises for their goods on this side of the water. The earthenware is a pleasing gray buff in color and the banded heating element is enameled in dark brown. The form of construction and the material employed leave the inside surface of the device clear and enable it easily to be kept clean. It can be used for a variety of purposes such as heating soups and other liquids and boiling eggs. With the addition of an inner vessel, the two-pint size makes an efficient milk sterilizer, cereal cooker and beef-tea brewer.

The largest device shown is a 2-pint "boiling jug" which, the makers state, will boil 2 pints of water in fourteen minutes. It is 8.5 in. high, 3.5 in. in diameter at the top and 6 in. at the bottom. These devices are made by the Sun Electrical Company, Ltd., London, England.

Direct-Current Motor Starters

A feature to be found in the direct-current motor starters which are being manufactured by the General Electric Company, Ltd., London, England, is the self-aligning contact block. This device has been introduced so that the starter may be able to adapt itself to the irregularities inevitably occurring in practice due to continued arcing. All contacts are renewable from the front and the no-voltage release coils are also made detachable for the reason that many users in ordering starters overstate the voltage of their service and consequently find that the no-voltage release will not hold the lever in the running position. When a case of this kind occurs the coil is removed and returned for rewinding.

For making the main contacts in the larger sizes of starters there are two brushes, one of carbon and one of brass, the carbon brush taking the arc and protecting the brass contacts. The starters are made in sizes ranging from 0.25 hp to 100 hp.

GRIPPER AND SIDE GUIDE

Commutator Insulation for Replacing Built-Up Mica

A new insulating material has been developed to replace mica for V-rings, bushings, taper rings, and the like. The dielectric strength of "formica," which is the name given the new product, is said to be 1000 volts per mil under all atmospheric conditions, as the material is non-hygroscopic and will not be affected by moisture. A commutator equipped with V-rings and bushings of the new material has shown its ability to withstand a potential of 20,000 volts to ground before breaking down. As to the thermal properties of the new material, it is said that it will stand 155 deg. C. continuously and 265 deg. C. momentarily, that it will not warp at any temperature, and that after baking it is infusible at any degree of heat even up to the temperature of carbonization. Mechanically, formica is tough and strong but not brittle, and it can be formed to any dimensions possible with built-up mica. Its ultimate tensile

COMMUTATOR INSULATION IN VARIOUS SHAPES

strength is stated as being 20,000 lb. per sq. in. and its ultimate strength under compression is 20,000 lb. per sq. in. in the direction of greatest weakness. Of the chemical characteristics of the insulation it may be said that it is practically unaffected by any of the common solvents, is impervious to oil, and will not absorb grease or carbon dust. This new insulating material is being marketed by the Electric Service Company, of Cincinnati, Ohio.

Improved Two-Cycle Oil Engine

The relatively high steam consumption of turbines ranging in rating from a few horse-power up to 500 hp leaves this portion of the generating field open to successful oil engines. Among the firms foremost in the development of this type of apparatus is the Allgemeine Elektricitäts Gesellschaft, which is now placing on the market an engine that has been subjected to severe operation on the test floor of the factory since 1910. Fig. 1 is a cross-section of a two-cylinder engine of this type. Two pistons working

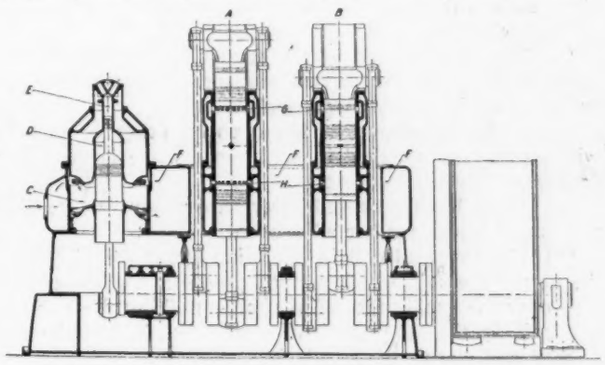


FIG. 1—CROSS-SECTION OF TWO-CYLINDER ENGINE

in the same cylinder are connected to the crankshaft so that at one dead-center position they will be at a minimum distance apart and at the other they will be at a maximum distance. The exhaust ports, shown at *G*, and the admission ports, at *H*, are so arranged that as the two pistons move from one extreme of their travel to the other both sets of ports are alternately opened and closed by the pistons themselves without the aid of valves. The injector pumps and scavenger pump are shown at *D*, *E* and *C* respectively. The letter *F* indicates the receiver and the working cylinders are shown at *A* and *B*.

The main points of advantage claimed for the engine by its makers are its superior scavenging qualities and low fuel consumption. The arrangement of the ports and their

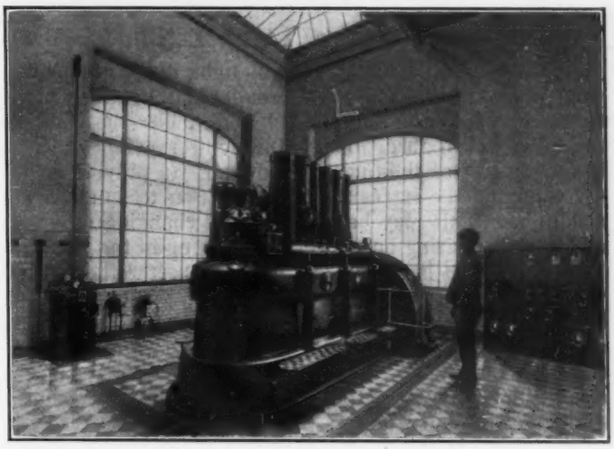
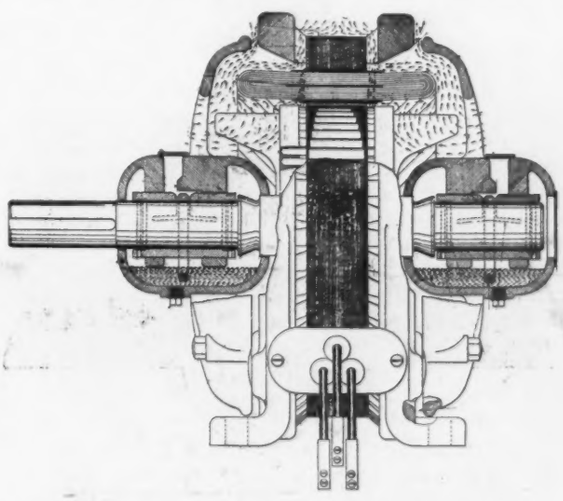


FIG. 2—TWO-CYCLE OIL ENGINE IN STATION

ample area of opening are cited as the chief features which make possible complete scavenging operations in this "two-stroke-cycle" engine. The fuel-oil consumption is said to be as low as any that has been obtained with low-speed four-stroke-cycle engines. The absence of heavy exhaust and admission valves renders the operation steady and noiseless.

Ventilated Induction Motor

An improved type of polyphase induction motor has recently been developed and placed on the market by the U. S. Electrical Manufacturing Company, of Los Angeles, Cal. Light, compact construction is made possible by the use of a riveted frame, thus eliminating the heavy cast-iron frame



IMPROVED TYPE OF VENTILATED INDUCTION MOTOR

of former days together with the dead-air pockets which it created. Exposure of the stator core directly to the air facilitates heat radiation. Air-directive fans on the rotor also insure good air circulation and low operating temperatures. Space fingers are cast on the end flanges so that liberal ventilating ducts are formed on each side of the stator-core punchings. The welded-ring type of construction in the

rotors makes it unnecessary to depend on solder for either mechanical strength or electrical conductivity. Elimination of paper from the rotor construction minimizes trouble due to burn-outs. The motors are made in both constant-speed and variable-speed types. The partial section of the motor illustrated herewith shows the paths of the cooling air.

Fixture Control of Light Distribution

An ingenious device to control light distribution from single-unit fixtures has been brought out by the George Cutter Company, of South Bend, Ind., under the name of the "Idealite" fixture. The manufacturer points out that in any system of lighting it is advisable to provide means for changing the intensity of illumination to suit varying conditions. This may be done without changing reflectors or lamps, by raising and lowering the lamp in the reflector. When the lamp is placed low in the reflector the light is widely distributed but has low intensity; with the lamp high in the reflector the intensity is high but the light is distributed over a small area. The accompanying illustration gives a sectional view of the fixture, showing the means of adjustment by which the lamp may be moved up or down through a range of 1 in.

The socket in this fixture is composed of molded insulation and is suspended from a steel body by means of three adjusting screws. Upon these screws are placed six spiral springs which support the socket and lamp, protecting the latter from vibration. A brass shell incloses the mechanism and serves also as a holder for the reflector or shade.

By means of the three adjustable screws the socket may be raised or lowered to bring the lamp into proper relation to the reflector to accomplish either concentration or various degrees of diffusion of light as desired. By taking advantage of this means of adjustment it is also possible to place

SECTIONAL VIEW OF ADJUSTABLE FIXTURE

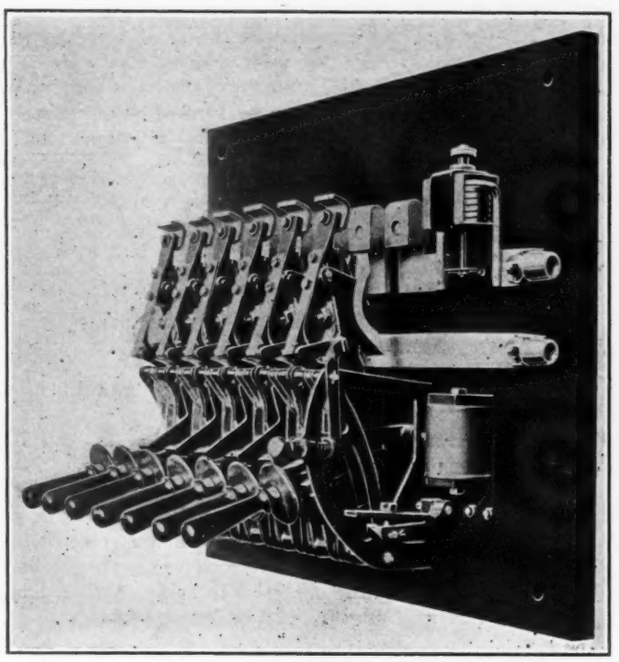
lamps of various candle-powers in proper relation to the reflector. This avoids the necessity of changing the reflector when changes are made in the size of lamps. These fixtures may be equipped with either enameled steel or glass reflectors to fit varying conditions of service.

The leading-in wires are attached to the socket by means of two substantial screws, thus avoiding the necessity of soldered connections in the fixture stand. The fixtures are furnished with canopy and with rigid stem or chain suspension, as desired. They may be equipped with ornamental glassware or with varying designs of steel-enameled light reflectors, according to requirements.

Multiple Lever Motor Starter

The following main features are possessed by the direct-current motor starter illustrated below.

(1) By means of the true "loose-handle" starting device



FRONT VIEW OF MULTIPLE-LEVER STARTER

the brushes cannot be held in the closed position, because they open automatically when an overload or no-voltage condition occurs during starting or subsequently, quite independently of the operating handles or operator.

(2) The "loose-handle" feature renders it impossible to start up too rapidly, and hence the motor is effectively safeguarded against excessive current and consequent troubles due to sudden starting.

(3) The overload devices can be fitted to much larger sizes than hitherto and can be equipped with time-limit devices when desirable.

(4) The construction of the starter is such that levers must be closed in the correct sequence, thus insuring the resistance being reduced gradually.

(5) The levers open in the opposite order to that in which they are switched in, and hence there is no heavy arcing on individual contacts.

(6) After having opened levers are ready for starting up again without further adjustment.

(7) The overload coil in operation opens the circuit of the no-voltage coil, which method possesses a great advantage over the usual practice of short-circuiting the no-voltage coil, in that the overload attachment breaks the no-voltage coil circuit under all circumstances.

(8) Regulation over any number of steps can be obtained if desired, while all the automatic features can be retained. Thus, if it is desired to eliminate a separate rheostat for speed regulation, additional levers over and above those required for starting only can be fitted in order to obtain the necessary rheostatic effect.

The above-described starter has been developed for the market by the British Westinghouse Electric & Manufacturing Company, Ltd., Trafford Park, Manchester, England.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

New Tariff Bill Signed.—The Simmons-Underwood tariff bill was signed by President Wilson on Oct. 3 and some portions went into effect immediately. The President expressed satisfaction with the measure and spoke concerning the importance of the currency bill now before Congress.

Licensed Under Mullin Patents.—The Nyelec Switchboard Company, of 39 Cortlandt Street, New York, has been licensed to work under the Mullin patents, covering a new form of vertical feeder support, made by the Norris Electric Specialty Company, of 38 Park Row, New York. The device was described in the Sept. 6 issue of the *Electrical World* and is being used by the first-named company in its work on the Haywood, Strasser & Voigt Building, at Twenty-sixth Street and Eleventh Avenue, New York.

Home Tax on Lighting Material Irksome.—German manufacturers of incandescent lamps claim to be seriously handicapped in their export trade, particularly to the United States and Canada, by the home tax on lighting materials imposed by the German government. It is stated that this tax has been added to the value of German exports by the customs authorities of both the countries mentioned in calculating the import duties, with the result that the German goods cannot compete in price with other goods in those markets. In fear that other countries may follow this example, two large German associations, representing electrical manufacturing interests, are preparing a petition to the Reichstag, urging the repeal of the tax.

General Electric Company Incorporated in Brazil.—The General Electric Company of Brazil has been incorporated to take care of the interests of the General Electric Company in that country. Guinle & Company, exporters, of 42 Broadway, New York, formerly the representatives of the General Electric Company in Brazil, have given up the electrical end of their business incidental to this change. The incorporation of a Brazilian company is in line with the General Electric policy of handling foreign business through separate companies holding foreign charters, and in addition to its English and European subsidiaries there are allied companies in Mexico, Paraguay and some others of the South and Central American republics.

Extensions in Jamestown, N. Y.—The Jamestown Street Railway Company is building an addition 75 ft. long and 63 ft. wide at its Boat Landing power house to house additional equipment, including eighteen transformers. It is reported that within a short time the company will install a 5000-kw Westinghouse-Parsons turbo-generator in the present power house. Two of the old high-speed Westinghouse engines and generators will be taken out to make room for the large new unit. The two turbo-generators now in service in the power house are each rated at 1500 kw. Connections will be made so that in case of necessity electrical energy from Niagara Falls, which now comes as far as Mayville, may be transmitted to Jamestown. Mr. Ira A. Douglass is the chief engineer of the Jamestown Street Railway Company.

Status of the Incandescent Lamp Industry in Austria.—A recent German technical paper in discussing the present position of the incandescent lamp industry in Austria stated that it is one of the few lines which have not suffered from the Balkan war. The demand for metal-filament lamps was stated to be especially active, and the restriction of the carbon lamp field was predicted, to accompany the introduction of more perfect methods for manufacturing the metallic-filament lamps. The present output of this type of lamp in Austria-Hungary is between 18,000,000 and 20,000,000 per year, or about twice the home consumption, so that a large number of them are exported. The carbon-lamp agreement which exists between German, Austro-Hungarian and Dutch firms expires next May, and it is predicted that this agreement will not be renewed, as manufacturers are of the opinion that, with the altered circumstances in the industry, free competition will prove the best policy.

New Wireless Station Assured.—The Marconi Wireless Telegraph Company of America has just closed a contract with the Norwegian government for the erection of a large wireless station in Norway, to connect with a similar station to be erected in Massachusetts. This latter will be a duplex installation, arranged so that messages can be sent and received simultaneously, and will be connected by wire with New York and Boston. It is stated that the Norwegian government is making arrangements at the present time for wireless communication with Sweden, Denmark and the north of Europe, and the Marconi Company is understood to have plans for a system connecting Europe and the United States with South America, to be followed by stations in Asia and Australia. The site for the Massachusetts station is understood to have been already purchased, and it is probable that the J. G. White Engineering Corporation, of New York, which is now building Marconi stations in New Jersey, California and the Sandwich Islands, will secure the contract for its erection and equipping.

Where Chicago Is Backward.—Chicago possesses thousands of apartment buildings, many of them handsomely appointed. But it is said to be behind every other large city in the country in the use of telephonic communication between the entrance and the various apartments. Speaking-tubes are still specified in buildings with sleeping porches, electric laundry equipment, wall safes, built-in bookcases, vacuum-cleaning outlets and other up-to-date improvements. A man who should know accounts for this state of affairs by saying that it is due to Chicago's telephone history. When the fundamental patents of the American Bell Telephone Company expired, about twenty years ago, Chicago was the center of the independent or anti-Bell telephone activity. Manufacturers of telephonic apparatus sprang up over-night almost. Many of these concerns were not equipped by knowledge or experience to make satisfactory telephones. At that time many inferior inter-communicating systems were put into Chicago apartment buildings, and the experience of architects and builders was so unsatisfactory that they are still prejudiced against the use of the telephone in place of the speaking-tube. Of course, since then the incompetent manufacturers have been weeded out, but the bad impression still remains apparently.

Electric Welding of Car Wheels Proves Successful.—The jarring incidental to the operation of an industrial railway car is particularly hard on the wheels, and where these are keyed to the axles both the keys and the keyways become worn and distorted very quickly and are then practically ready for the scrap heap. In some instances it has been found practicable to shrink the wheels onto the axles, but this method is not adaptable for every class of service. The Electric Welding Company, of 220 West Forty-second Street, New York, has developed a method for taking care of this difficulty which has proved successful under trying operating conditions. On the outside or bearing face of the wheel hub the axle bore is beveled and a weld made between the wheel and axle by the arc-welding process, the metal deposited filling the beveled section and being finished finally to the surface of the hub. On the inside face of the hub a weld is made between the wheel and axle, allowing the deposited metal to build up, since in this place it does not interfere with the bearing. The process above described has been applied to the cars used by the Nichols Copper Company for hauling hot ingots and metallic ores and has given

satisfaction where the keying and shrinking methods have failed. The Nichols company has all of this work done on contract, thereby avoiding the necessity of buying an expensive special outfit and of maintaining the force of skilled mechanics and engineers necessary to its successful operation.

Allis-Chalmers Establishes Office in Indianapolis.—The Allis-Chalmers Manufacturing Company has recently opened an office in Indianapolis, Ind., from which all of the business in that State will be managed. This is the first time that the company has had an office in Indiana, the Chicago office handling this territory before. Mr. O. C. Ross is sales engineer and manager of the office, which is located in the Traction Terminal Building.

Unusual Telephone Installation.—On two telephone switchboards supplied by the Western Electric Company for use at Buckingham Palace, instead of the usual numbering of the local line jacks, each jack is labeled with a small plate giving the full designation of the person or place with which it is desired to communicate. The two boards were installed because it was not desired to have the day exchange occupied at night. The reason for this is not known.

Tree-Cutting by Electricity.—Mr. F. C. Enright, the representative of the Chicago Association of Commerce in Buenos Aires, has received a request from the Forestry Bureau of the Department of Agriculture of the Argentine government for complete information relating to the method of cutting trees by the use of resistance wires rendered white hot by a current of electricity. The Argentine officials believe that this plan is in use in the United States. The business manager of the Chicago Association of Commerce will forward to those interested any information in relation to this particular method of tree-cutting.

New Vacuum Cleaner Marketed.—The Hoover Sweeper Company, of New Berlin, Ohio, with a New York office in the Marbridge Building, Broadway and Thirty-fifth Street, has recently added to its line of electric vacuum cleaners the "Baby Hoover," which operates on the same principle as its large cleaner but is about one-third the size and price of that machine. The company is pushing its foreign sales as well as those in the United States and already has a foothold in Europe and South America. It markets its goods through large department stores and hardware shops and through central stations. These mediums are used simply for distribution centers, and the company carries on its advertising and selling campaign in the same way as if they were branch offices. This system takes from the distributors the burden of pushing the sale of the cleaners and, since an effort is made to use only the highest grade stores as distributing agents, better and more economical results are probably attained than if the company tried to establish branch stores of its own for the same purpose.

Electrical Equipment of the Adams Express Building in New York.—Construction work is nearing completion on the new Adams Express Building, at 35 Trinity Place, New York. This structure when completed will stand thirty-two stories above street level, quite a little higher than any of the buildings immediately adjacent. Its generating equipment will consist of three 400-kw Westinghouse three-wire 125-250 volt units and one 200-kw unit of the same type, all driven by cross-compound Hamilton Corliss engines, supplied by the Hooven, Owens, Rentschler Company, of Hamilton, Ohio, and operating on 150 lb. steam pressure. The boiler equipment is to be supplied by the Babcock & Wilcox Company, of New York, and will consist of three boilers of 500-hp rating and one of 375-hp rating. The main switchboard equipment consists of a generator panel at each machine and two distributing panels, one at the east and another at the west end of the building. The lighting service for the building will call for about 4000 plug outlets, and approximately the same number of ceiling outlets and wires will be drawn in galvanized concealed conduits. In addition to the lighting load, the generating equipment will supply energy for the operation of twenty-four Otis passenger elevators as well as for the electrically driven vacuum cleaning system, hot-water-circulating pumps and centrifugal exhaust fans. The installation of a double system of busbars in this building will add reliability to the electrical service and aid in preventing the elevator load from seriously interfering with the lighting service. Messrs. Griggs & Holbrook, of 3 South William Street, are the engineers on this building, and the electrical contracting is being done by L. K. Comstock & Company, of 30 Church Street, New York.

English Manufacturers Reduce Prices on Metallic-Filament Lamps.—The General Electric Company, Ltd., of London, announces that further technical progress in connection with drawn-wire filaments, combined with increased output of the Hammersmith Osram Works, has enabled it to effect further economies in the manufacture of tungsten lamps. The company has consequently decided to give the benefit of these reductions to its customers and has made a considerable reduction in the prices as quoted in its catalog. This reduction in most cases amounts to about 10 per cent on the list prices. The Siemens Brothers Dynamo Works, Ltd., of London, also state that they have decided to give a similar reduction in price on their tantalum metallic-filament lamps and tungsten drawn-wire lamps. From the British Thomson-Houston Company, Ltd., of Rugby, it is learned that prices will be reduced on its tungsten lamps, owing to improvements in the manufacturing end of its business brought about by the introduction of the drawn-wire process of making the filaments. Another concern which has taken this step is the British Westinghouse Electric & Manufacturing Company, Ltd., of Manchester, which has made a reduction of about 10 per cent in the prices of its tungsten drawn-wire lamps. These lamps are now in use under conditions which precluded their use in the earlier days, and with the present manufacturing process a stronger and more durable filament is secured than could be made formerly. Other companies announcing reductions are the Pope Electric Lamp Company, Ltd., of London; Cryselco, Ltd., of Bedford; Edison & Swan United Electric Light Company, of Middlesex; the Brimsdown Lamp Works, Ltd., of London, and the Foster Engineering Company, Ltd., of London.

September Statement of the Copper Producers' Association

While the stocks of copper on hand on Aug. 31 were the lowest ever reached in the history of the association, the September record gives a further falling off in this item, as shown by the following summary:

	September, pounds		August, pounds	
Stocks on hand in the United States on first of month		38,314,037		53,594,945
Production		131,401,229		131,632,362
		169,715,266		185,227,307
Domestic deliveries	66,836,897		73,649,801	
Foreign deliveries	73,085,275		73,263,469	
		139,922,172		146,913,270
Stocks on hand at end of month		29,793,094		38,314,037

NEW YORK METAL MARKET PRICES

	Sept. 29 Bid.	Sept. 29 Asked.	Oct. 7 Bid.	Oct. 7 Asked.
Copper:				
Standard, spot*	.....	.....	.....	.....
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	72 10 0		73 7 6	
Prime Lake	16.75	.....	16.75	to 16.87½
Electrolytic	16.40	to 16.60	16.50	to 16.60
Casting	16.30	to 16.40	16.25	to 16.37½
Copper wire base	17.75	.....	17.75	.....
Lead		4.75		4.60
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f. o. b. smelter		8.00		7.75
Spelter, spot	5.65	to 5.70	5.45	to 5.55
Tin, spot	41.40	to 41.60	40.35	to 40.60
Aluminum:				
Prompt delivery	21.50	to 22.50	20.00	to 21.00
Future	.....	.....	20.00	to 20.50

*OLD METALS

Heavy copper and wire	15.00	15.00
Brass, heavy	9.75	9.75
Brass, light	8.50	8.50
Lead, heavy	4.65	4.50
Zinc, scrap	4.75	4.75

*COPPER EXPORTS

Total tons to Oct. 7 5054

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Stock Issue Planned by the Boston Edison Company.—At the annual meeting, scheduled for Oct. 14, the stockholders of the Edison Electric Illuminating Company of Boston will be asked to authorize the directors to make application to the Board of Gas & Electric Light Commissioners for authority to issue $2,275,600 additional capital stock, the proceeds being intended for use on extensions and improvements to the company's property. Stockholders will have an opportunity to subscribe this issue when authorized, on a basis of one new share to every eight shares held. The company has made a very attractive power rate and is pushing that end of its business.

South American Utility Has Prosperous Year.—The Brazilian Traction Light & Power Company, which was formed by a consolidation of the Rio de Janiero Tramways, Light & Power, the Sao Paulo Tramways, Light & Power and the Sao Paulo Electric companies, finished the first year of its organization on Aug. 31. During that period the earnings amounted to $22,741,102 in the gross, which corresponds to a net of $12,471,102, or nearly 12½ per cent on the common stock outstanding. As this is the first year of the consolidation, comparisons with previous figures are impossible, but the earnings as recorded above were well up to the estimates made at the time of organization.

West Penn Traction & Water Power Matters.—During the twelve months ended Aug. 31, 1913, the West Penn Traction & Water Power Company not only earned the 6 per cent dividend on its $6,497,400 of preferred stock, but after payment of the same had left a balance of $207,422, or over 1 per cent on the outstanding issue of $20,497,400 common stock. This company, which is one of the American Water Works & Guarantee Company's subsidiaries, has been increasing its earnings steadily. It is making a large number of new power contracts and as it is favorably located with respect to the coal, iron and steel industries of Pennsylvania, a field in which electric power applications are rapidly growing, it looks forward to large future expansion along these lines.

October Bond Interest Paid by the American Water Works & Guarantee Company.—The receivers of the American Water Works & Guarantee Company have made arrangements to pay the interest due Oct. 1 on all of the bonds guaranteed by that company, with the exception of the interest on the notes of the United Water & Light Company and on the bonds of the St. Joseph Water Company, the California-Idaho Company and the Twin Falls-Oakley Land & Water Company. There is every probability that the first two of these four companies will be cared for in this respect within a few days, since according to reports the water companies are earning well in excess of their fixed charges, including interest on their bonded debt. The delay in the case of these companies is stated to be due to the necessity for obtaining court action preliminary to making the payments. A protective committee is being formed to look after the interests of the irrigation bond holders, and a call is expected shortly to all such parties to deposit their certificates with this protective committee.

Further Call for Utah Securities Corporation Notes.—Ten per cent of the Utah Securities Corporation's $27,500,000 note issue has been called for, payable 5 per cent on or before Oct. 17 and 5 per cent by Nov. 5, bringing the total amount called to date up to 70 per cent of the issue. Future call on the remainder of these notes, during the rest of the year, will depend largely on the weather conditions. If an open winter is experienced, the improvement and extension work for which the issue was made will be carried along rapidly and one or perhaps two more calls may be made. With a continuation of this work at the present rate, it is evident that more money will be required for it within the year. The corporation is now earning about $1,000,000 net per annum. There is approximately $5,000,000 going into development work, not yet completed, so that interest on this portion of the notes is properly chargeable to construction cost. Allowing for this, the company is earning enough now to cover its 6 per cent interest obligations with a slight margin over.

Southern Utility Plans to Take Over Municipal Plant.—The Southern Gas & Electric Company, known formerly as the Baltimore Utilities Company and having its headquarters in Baltimore, Md., has made an offer to take over the municipal gas plant at Richmond, Va., and operate it as a private plant. It is proposed to pay an annual rental of $140,000 and 1 per cent of the annual gross receipts on a thirty-year lease. Gas is to be furnished at 80 cents per 1000 cu. ft. for the first ten years and at 75 cents per 1000 cu. ft. for the last twenty years, as compared with the rate of 80 cents now charged. A bond of $500,000 was offered for the carrying out of the contract. The company agreed also to expend not less than $1,000,000 on extensions and improvements during the first three years of the lease. The contract has not yet been approved by the city. The Southern Gas & Electric Company was formed for the purpose of acquiring and developing gas and electric properties in the South, and it now controls the Suffolk Gas & Electric Company, the Bluefield Gas & Electric Company and the Sumter Gas & Eletric Company.

Westinghouse Electric Company Makes Part Payment on Maturing Note Issue.—Of the $1,500,000 of collateral trust notes of the Westinghouse Electric & Manufacturing Company, maturing Sept. 27, $250,000 were paid off with cash held in the company's treasury and the balance were extended for nine months. These notes were in the form of a bank loan, distributed among a number of the banks with which the company does business, and their extension was readily obtained. The extension makes these notes fall due on June 27, 1914, only about a month before $4,000,000 of collateral 6 per cent notes are due, on Aug. 1, but as the company is now earning a liberal balance over dividend requirements, it is thought that part or all of the extended note issue can be paid off at maturity. Since the close of the last fiscal year there has been a material reduction in the outstanding floating debt, and to-day the property is in better shape financially than it has been for a long time past. The business of the company has been unusually good for the past few months, and this condition is expected to last for some time, although perhaps not at the same record figures. With the spread of trunk-line electrification the company expects to do a very large business, since this is one of the branches in which it has specialized, doing work for the New Haven, the Pennsylvania and the Long Island roads in this connection. It has secured the contract for the Norfolk & Western electrification and is figuring on similar work for the St. Paul road.

Note Issue of the Virginian Power Company.—The Virginian Power Company, of West Virginia, is offering for subscription $1,250,000 first-lien 6 per cent notes dated August, 1913, and maturing Feb. 1, 1915. The offering is made at 98.5, and included with the purchase of each $1,000 of these notes are rights to subscribe to $1,000 first and collateral trust 5 per cent bonds at the underwriting price when these bonds are issued and a bonus of $100 of the company's common stock. An additional bonus of $100 common stock will be given if the right of subscription is subsequently exercised. The new note issue is secured by the deposit of $2,500,000 of the first and collateral trust 5 per cent bonds which are a first lien on the 27,000-hp steam station now under construction in the Kanawha-New River coal district. In addition to the construction of this steam station the company is building 160 miles of high-tension transmission lines in the same district where energy is to be furnished for operating the coal mines. Water-power sites with an aggregate capacity of 170,000 hp are controlled by the company, and the initial hydroelectric development is to be made at Bluestone, where there is 125,000 hp available. In connection with this development it is understood that the company plans to build transmission lines to Cincinnati and the adjacent towns The steam plant above mentioned was built to stave off a threatened series of isolated generating station installations for supplying energy for the large coal mines in the vicinity. On the completion of the hydroelectric plants this steam station will take its place as an auxiliary source of energy, and, in the mean time, it will be able to care for the business secured in advance of the completion of the water-power stations.

Business Notes

The American Insulating Machinery Company is now located at the corner of Huntingdon and Fairhill Streets, Philadelphia, instead of Fairchild Street, as announced in the issue of Sept. 27.

The Crypto Electrical Company, of 159 Bermondsey Street, London, England, has built a large addition to its factory at Willesden. This new factory is now being equipped and will be in operation within the next few weeks.

Rosenbaum & Stockbridge, patent attorneys, of 41 Park Row, New York, announce that they have associated with them Victor D. Borst, who has been engaged for several years in the practice of patent law before the Patent Office and the federal courts. The firm will be known as Rosenbaum, Stockbridge & Borst.

The Monmouth Electric Company, manufacturer of wireless-telegraph instruments, has located its office and plant at 92 Murray Street, New York, and completed arrangements for the manufacture of its product. C. H. Hopper, the president of this company, was formerly secretary and general manager of the firm of Hunt & McCree.

The Blackburn Specialty Company, Cleveland, Ohio, manufacturer of ground clamps and locks for electric automobiles, moved into its own new fireproof building, corner Thirty-fifth Street and Perkins Avenue, Cleveland, about Oct. 1. The structure measures 70 ft. by 100 ft. in plan, and the company will have at its disposal for manufacturing operations nearly 30,000 sq. ft. of floor space.

New Industrial Companies

The Magic Fire Alarm Company, of Fairfield, Maine, has been incorporated with a capital stock of $10,000 to manufacture and deal in electrical and other fire alarms. Thomas Burke is president and A. S. Burke treasurer.

The Automatic Train Control Company, of Kansas City, Mo., has been granted a charter with a capital stock of $2,000,000 to manufacture and deal in mechanical and electrical devices for block signals and safety appliances.

The G. & W. Electric Specialty Company, of Chicago, Ill., has been incorporated by H. T. Haines, W. G. Colvin and R. F. Carter, all of Chicago. The company is capitalized at $250,000 and proposes to manufacture electric specialties.

The Automatic Electric Sign Company, of New York, N. Y., has been chartered with a capital stock of $10,000. The incorporators are Walter E. Godfrey, Emanuel Friedman and Harry O. Liberman, all of 135 Broadway, New York, N. Y.

The Eveland Electric Riveter Company, of Camden, N. J., has been chartered with a capital stock of $10,000 to acquire patents and assignments and to manufacture and deal in articles of metal or wood or both. The incorporators are S. S. Eveland, E. A. Reeve and John A. MacPeak.

The Grant Vacuum & Sales Agency, of Providence, R. I., has been incorporated with a capital stock of $10,000 to manufacture and deal in vacuum cleaners and selling electrical devices. The incorporators are Irving A. Salisbury, Arthur C. Jenney, Susan A. Grant and Horace M. Grant.

Trade Publications

Lighting Fixtures.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, has recently issued a number of temporary catalog pages which illustrate some new designs in luminous bowl fixtures.

Induction Motors.—Type CS squirrel-cage induction motors for constant-speed service are fully described and illustrated in Descriptive Leaflet No. 2321, issued by the Westinghouse Electric & Manufacturing Company.

Used Machinery.—Calvin H. Currier, 141 Milk Street, Boston, Mass., has issued a list of used steam and electrical apparatus for sale by him at the present time. The list includes alternating-current and direct-current motors, engines, pumps, boilers and other apparatus.

Transformers.—W. E. Burnand & Company, Chippinghouse Works, Lowfields, Sheffield, England, have issued a catalog devoted to transformers. It contains fifty-eight pages, numerous illustrations and some efficiency curves, including a general description of the apparatus.

Steam Turbines.—The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., in Bulletin No. 1084, treats very fully the subject of its steam turbines and generators. Numerous illustrations and diagrams showing the construction features of this apparatus accompany the text.

Reflectors.—Harvey Hubbell, Inc., is sending out attractive advertising literature in poster effect, folded for mailing. One of these folders, size 19¼ in. by 12½ in., contains an illustrated talk on Hubbell reflectors. Another tells about Hubbell lamp guards and their effectiveness in guarding against breakage and theft.

Ozonators.—In Bulletin No. 850, the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York, discusses its industrial ozonators. A general talk on ozone, its properties, production and application, is followed by information on ventilation and air purification and a description of the industrial ozonator with illustrations and diagrams showing its features of construction.

Connectors.—The Sloan Engineering Company, 240 Hall Street, Brooklyn, N. Y., has recently published a booklet entitled "Standardization as Applied to Binding Posts." The connector which is described is designed for making electrical and mechanical connections with any type of wire or wire tip. Information regarding the design, use and carrying capacity of the binding post is given, together with a few illustrations.

Booklet on "Pioneers."—The Wagner Electric Manufacturing Company, St. Louis, Mo., has issued a booklet of sixteen pages entitled "Pioneers; Wagner Quality." The attractive cover appropriately illustrates the trials of the pioneer, and the reading pages contain short sketches illustrated by photographs of pioneers in electrical science, as well as brief outlines of pioneer apparatus developed by the Wagner company.

Engineering Installations.—L. B. Stillwell, consulting engineer, 100 Broadway, New York, has brought out an attractive brochure, entitled "Twenty Years' Progress," which gives a brief account of various important engineering works designed and supervised during the past twenty years by engineers now associated with the firm. These include a number of notable installations. The booklet is well printed and illustrated.

Electrical Appliances.—The Hotpoint Electric Heating Company, Ontario, Cal., is sending out a broadside addressed to dealers urging them to make window displays modeled after the company's double-page advertisement in one of the prominent weeklies of general circulation. Practical suggestions are given to this end referring to the fireless cooker, and a section of the sheet is arranged for the dealer to use as a poster.

Switches.—The Hart & Hegeman Manufacturing Company, Hartford, Conn., is distributing Catalog "K," a neatly arranged publication of sixty-four pages which lists and pictures "H. & H." switches and accessories. The line includes a large variety of switches. Diagrams of wiring connections for rotary surface switches, rotary flush switches and push flush switches are shown, and a complete index and price list are given.

Traveling Electric Hoist.—The Pawling & Harnischfeger Company, of Milwaukee, has issued a recent bulletin (No. 301) describing its new type U hoist. The use of traveling electric hoists in handling material in manufacturing plants is growing rapidly. The type U hoist is designed for normal speed and ordinary operation and is made in several different types. Both direct-current and alternating-current equipment can be furnished, the motors ranging from 1.25 hp to 7.5 hp. The bulletin describes briefly design and construction, with illustrations, drawings and data tables.

Personal Mention

Mr. F. E. Stevens has resigned as superintendent of the accounting department of the Edison Electric Illuminating Company of Boston.

Mr. Philip R. Dunton has succeeded Mr. T. C. Miller as superintendent of the municipal electric-light plant and water-works at McPherson, Kan.

Mr. R. P. Stevens, retiring president of the Lehigh Valley Transit Company, Allentown, Pa., was tendered a banquet at the Elks' Club, Sept. 30, by the heads of the departments.

Mr. H. J. Willis, who has been superintendent of the La Crosse (Kan.) municipal light and power department for the past six years, has become associated with the water and electric light department at Scott City, Kan.

Mr. J. Duhan has been made manager of the Montana Electric Company, a jobbing house of Butte, Mont., to succeed Mr. R. C. Kemp. Mr. Duhan came from the Westinghouse company at Salt Lake City two years ago, when he was made assistant manager.

Mr. Attila Norman, retiring manager of the Freeport (Ill.) Railway & Light Company, was tendered a farewell dinner at the Freeport County Club, Oct. 2, by the leading business and professional men of that city. A desk set of copper with silver applied was presented to Mr. Norman by the assembled guests.

Mr. H. E. Grant, sales manager in the San Francisco office of the Holophane Works, has joined the editorial staff of the *Journal of Electricity, Power and Gas* of San Francisco. Mr. Grant was formerly in the engineering and commercial departments of the British Columbia Electric Railway Company at Vancouver.

Prof. Frank G. Wilson, for the past three years assistant professor of electrical engineering in charge of the laboratories of that department at the University of Illinois, has been appointed head of the electrical department at the Wentworth Institute, Boston. Professor Wilson is a native of Bozeman, Mont., and was educated at the Montana State College, University of Wisconsin and University of Illinois.

Mr. A. H. Fehr has been chosen president of the Lehigh Valley Transit Company, of Allentown, Pa., as successor to Mr. R. P. Stevens, whose resignation was announced in these columns on Aug. 23, 1913. Mr. Fehr was formerly connected with the Easton Transit Company, which recently became part of the Lehigh Valley Transit Company's system. The Lehigh Valley Transit Company controls the Allentown Electric Light & Power Company and leases the Bethlehem Electric Light Company and the South Bethlehem Electric Light & Power Company.

Mr. T. I. Jones, general sales agent of the Edison Electric Illuminating Company of Brooklyn, has been engaged by the Department of Education of the city of New York to deliver a series of lectures on electrical subjects on the Friday evenings of October and November. The subjects of lectures, beginning with that of Oct. 17, are as follows: "Electric Motors," "Electric Railways," "Electric Heating and Welding," "Incandescent Electric Lighting," "Arc, Vapor and Non-vacuum Lamps," "The Telephone and Telegraph" and "Wireless Telephone and Telegraph Systems." All of the lectures will be illustrated by apparatus in operation and stereopticon views and will be delivered in the assembly hall of the public library at Fourth Avenue and Fifty-first Street, Brooklyn.

Mr. Emmett MacDonald, the newly elected president of the Illinois State Electric Association, has been a valued member of the association for a number of years, having served as treasurer several years ago and being promoted from the position of second vice-president to the presidency. He is and has been for eleven years superintendent of the Lincoln (Ill.) Water & Light Company. He is a sensible, level-headed man of Scotch extraction and is a believer in the benefits of co-operation in association work. In addition to his connection with the Illinois association, he is a member of the National Electric Light Association, the American Waterworks Association and the Illinois State Water Survey. Mr. MacDonald, who is about forty-five years of age, is a man of few words, but his good judgment commands the respect of his associates.

Obituary

Charles Heideloff, of Hyde Park, Mass., for many years prominent in the electrical business in Boston, died Sept. 19. Mr. Heideloff had just returned from Germany, whither he had gone in search of health.

William W. Gamewell, former treasurer of the Stanley Electric Company of Pittsfield, Mass., and a director of electric companies at Greensboro, N. C., Madison and Sheboygan, Wis., died at Sheboygan on Sept. 21.

F. P. Catchings, a well-known Southern electrical engineer, was drowned off Atlantic Beach, Fla., Sept. 21. Mr. Catchings was educated at Emory College and Vanderbilt University and for several years was chief electrical engineer of the Georgia Railway & Electric Company of Atlanta, Ga. At the time of his death he was superintendent and electrical engineer of the Alabama Power Company of Birmingham, Ala., having gone to that city from Atlanta about one year ago.

R. D. Apperson, until recently president of the Lynchburg (Va.) Traction & Light Company, died at Santa Monica, Cal., Oct. 6. Mr. Apperson was born in 1863 and in 1886 became connected with the Little Rock (Ark.) & Citizens' Street Railway, remaining with that company until 1890, when the property was sold. He then went to Staunton, Va., where he built an electric railway, of which he assumed the management, and later also built and operated at Staunton an electric light and gas plant. Mr. Apperson and his associates purchased the property of the Petersburg (Va.) Gas & Light Company and the Lynchburg Gas Company in 1899 and two years later acquired the Lynchburg Electric Railway & Light Company and the Lynchburg & Riverton Street Railway. These properties and that of the gas company were afterward consolidated as the Lynchburg Traction & Light Company. In 1903 the Apperson interests purchased the property of the Roanoke Railway & Electric Company, and when, in 1910, the American Railways acquired the property of both the Lynchburg Traction & Light Company and the Roanoke Railway & Electric Company Mr. Apperson continued as president and general manager of both and became a director of the American Railways. Mr. Apperson resigned a few months ago as president of the Lynchburg Traction & Light Company, but continued as chairman of the board of directors of the new company and of the Roanoke Railway & Electric Company.

Robert Edwards, who established the firm of Edwards & Company, Inc., manufacturing electricians of New York, died at his residence in Lowerre, Yonkers, N. Y., Sept. 27, 1913. Mr. Edwards was born September, 1838, in London, and came to the United States in 1847. He first resided in Fond-du-Lac, Wis., but in 1849 moved to New York City with his family. After completing his education at Manhattan College in that city Mr. Edwards entered the jewelry business and for many years was with the firm of Bishop & Rein in the old Fifth Avenue Hotel. In the early seventies he entered the electrical business and in 1872 organized Edwards & Company as a contracting concern. The business of the company has been carried on continuously from that time. During the early days of Mr. Edwards' career the company merely manufactured material for its own use, but about ten years ago the manufacturing interest became prominent, the construction end of the business was disposed of and all the energies of the concern were devoted to manufacturing. Mr. Edwards continued as the head of Edwards & Company until about five years ago, when he retired from the active management, although he still retained an interest in the business and was the president of the company at the time of his death.

ROBERT EDWARDS

Construction

New England

ENOSBURG FALLS, VT.—A new smokestack will be erected at the municipal electric-light plant within the next two weeks (already purchased). The town expects to build a new power house and install new equipment within the next three years. D. H. Bailey is superintendent.

BOSTON, MASS.—At the annual meeting of the stockholders of the Edison El. Illg. Co. of Boston to be held Oct. 14 the stockholders will be asked to authorize the directors to apply to the Board of Gas and Electric Light Commissioners for permission to issue 22,756 shares of additional capital stock, the proceeds to be used to pay for extensions and improvements to the property.

BOSTON, MASS.—The Commonwealth Ice & Storage Co. of Boston, Mass., will install a cold-storage and power plant on Pier 6, Northern Avenue, to furnish light, power and refrigerating service for the fishing industry on Pier 6. The equipment will consist of four 500-hp vertical water-tube boilers (Erie City Iron Works); Taylor stokers; two 14-in. by 18-in. Lentz simple engines, 200 r.p.m.; four 21-in. and 36-in. by 36-in. cross-compound Lentz engines, 45 r.p.m., manufactured by the Erie City Iron Works, and two 185-kva, 60 cycle, three-phase, 220-volt Triumph generators. Coal-conveying machinery and switchboard equipment have not yet been purchased. About 80 meters and 30 arc lamps will be required, contracts for which have not yet been placed. All wires will be placed underground. Sterrett & Benson, 156 State Street, Boston, Mass., engineers, have charge of the work.

BROCKTON, MASS.—A special meeting of the stockholders of the Edison El. Illg. Co. of Brockton has been called for Oct. 24 to vote on the proposition to increase the capital stock of the company by 3162 shares, the proceeds to be used for improvements and additions to its plant, the chief items being an extension to the East Bridgewater station and the installation of equipment to increase the output by 5000 kw.

FALL RIVER, MASS.—The State Board of Gas and Electric Light Commissioners has granted the Fall River El. Lt. Co. permission to issue 2000 shares of additional capital stock at $150 per share to pay for floating indebtedness and for improvements and extensions.

GREENFIELD, MASS.—The Greenfield El. Lt. & Pwr. Co. has been granted permission by the State Gas and Electric Light Commissioners to issue $250,000 in capital stock, the proceeds to be used for payment of debts already incurred and for additional extensions and improvements to its property.

NORTH ATTLEBORO, MASS.—The Electric Light and Water Department has awarded the contract for the erection of a three-phase transmission line to the manufacturing plant of the J. F. Sturdy Sons Co., jewelers, to Fred S. Ley & Co., of Boston, Mass. William Plattner is manager of the electric light and water department.

Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until Oct. 14 for repairs, alterations and additions to the electric equipment in Public School 20, Union Avenue and Keap Street, borough of Brooklyn. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent, estimating room, Park Avenue and Fifty-ninth Street, New York, and also at branch office, 131 Livingston Street, Brooklyn.

CHITTENANGO, N. Y.—The contract for lighting the streets of the village has been awarded to W. J. Phillips, owner of the Manlius electric-light plant.

COLTON, N. Y.—The Public Service Commission has granted the Northern Pwr. Co., of Potsdam, permission to erect a distribution system in Colton to furnish energy for lamps and motors.

ITHACA, N. Y.—An order has been issued by Justice Giddings permitting the receivers of the New York, Auburn & Lansing Ry Co. to issue certificates for $90,000 for improvements to the Remington power plant, purchased last spring. H. A. Clark, of Ithaca, is general manager.

ITHACA, N. Y.—Bids will be received by E. L. Williams, treasurer Cornell University, Ithaca, until Oct. 16 for construction, heating and ventilating and electric work for the stock-judging pavilion and agronomy building at the New York State College of Agriculture, Cornell University, Ithaca. Bids will be received for each division of the work separately and no combination of bids will be considered. Plans and specifications and black forms of proposals may be obtained at the office of Green & Wicks, architects, 110 Franklin Street, Buffalo, N. Y., upon deposit of $25, to be refunded upon return of plans. Plans and specifications are on file at the office of Lewis F. Pilcher, state architect, Capitol, Albany, and at the office of the treasurer of Cornell University, Ithaca.

MARCELLUS, N. Y.—The Marcellus Lt. Co. contemplates some extensions to its distribution system. The company purchases energy to operate its system. F. W. Knapp is manager.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of schools, Park Avenue and Fifty-ninth Street, New York, until Oct. 14 for installing fire-alarm telegraph system in Public Schools 5, 8, 90, 119 and 169, borough of Manhattan; also for additions and repairs to electric equipment in Public Schools 13, 49 and 70, borough of Manhattan. A separate proposal must be submitted for each school. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent, at estimating room, Park Avenue and Fifty-ninth Street, borough of Manhattan.

NEW YORK, N. Y.—Bids will be received by Henry S. Thompson, commissioner of water supply, gas and electricity, Department of Water Supply and Electricity, Room 1903, 13 to 21 Park Row, New York, until Oct. 15 for furnishing and installing switchboards, electrical wiring and all appurtenances, together with control cables, in underground ducts, from the South Street high-pressure pumping station to the gate vaults in the Bowery south of East Houston Street, and in Stone Street between Whitehall and Broad Streets; also from the West Street high-pressure pumping station to the gate vault located in Hudson Street south of North Moore Street. Blank forms, together with copy of contract, including specifications, may be obtained upon application to the above office.

NIAGARA FALLS, N. Y.—The lighting committee of the Business Men's Association has decided to form a stock company to install and operate an electric plant. The company will be capitalized at $75,000 and will file application for a franchise to operate in this city. Peter F. Jenss, Isaac Bier and Henry A. Welch are directors.

OAKFIELD, N. Y.—The Village Board has granted the Genesee Lt. & Pwr. Co., of Batavia, a franchise to furnish electricity in Oakfield. The board has entered into a contract with the company for a period of 10 years. The company has purchased the distribution system and other equipment of the United States Gypsum Co., which for several years has furnished electrical service to the village. The Genesee company proposes to erect a transformer station in Oakfield.

SALEM, N. Y.—The Salem Lt., Ht. & Pwr. Co. expects to purchase within the next three months some graphic meters. W. H. Simpson is superintendent.

SCHENECTADY, N. Y.—The contract for electric wiring of three new schools, one to be erected at Van Vranken Avenue and Salina Street, one at Seventh Avenue and Webster Street, and the third at Guilderland Avenue and William Street, has been awarded to Finch & Hahn, of Schenectady, at $3,337 for each of the two smaller schools and $5,995 for the large school.

CORRY, PA.—The new management of the Corry City El. Lt. Co., it is reported, is preparing plans for extensions and improvements to the plant, including the construction of a new boiler room. Orders have been placed for a 60-ft. stack.

PHILADELPHIA, PA.—Plans are being prepared by Biberman Brothers for the erection of a reinforced-concrete building, 77 ft. by 120 ft., and installation of a 300-hp power plant. The equipment of the power plant will consist of two 150-hp boilers, one 150-kw generating unit, one 50-kw generator and a radial brick stack. The cost of the building is estimated at $175,000, and bids will be received Nov. 15. Bids for power plant will be received Nov. 30, to cost approximately $25,000. Sauer & Hahn, 1112 Chestnut Street, Philadelphia, are architects.

PITTSBURGH, PA.—The battery shop of the Fort Wayne Railroad shops, in the North Side, was recently destroyed by fire, causing a loss of about $15,000. All of the machinery in the shop was destroyed.

PITTSBURGH, PA.—Bids will be received until Oct. 14 by the Board of Inspectors of the Western Penitentiary, Pittsburgh, for electric equipment for the death house on property of the Western Penitentiary, Rockview Station, Pennsylvania Railroad. Drawings and specifications may be seen at the Western Penitentiary, Pittsburgh, at the prison, Rockview Station, and at the office of John T. Windham, architect, Commonwealth Building, Philadelphia. An appropriation of $50,000 has been made for the building and equipment. John Francies is superintendent of construction, Western Penitentiary, Pittsburgh.

STONESBORO, PA.—Notice has been filed with the State Department at Harrisburg of the absorption by the Mercer County Lt., Ht. & Pwr. Co. of the Stoneboro, Lake, Fairview, Sandy Lake and Sandy Lake Suburban Pwr. Companies, all recently chartered to operate in Mercer County. The Mercer County company will furnish energy to a large territory.

MILLBURN, N. J.—Bids will be received by the Millburn Township committee, First National Bank Building, Millburn, until Oct. 14 for furnishing and installing fire-alarm equipment; also for reconstruction of the present out-of-doors or aerial lines of fire-alarm wire used in connection with the fire-alarm system in accordance with specifications now on file in the office of the township clerk. Proposals may be submitted for the entire work, or separate proposals for the equipment and wire reconstruction work will be received. Ernest L. Smithers is chairman of committee.

RAMSEY, N. J.—The Borough Council is contemplating the installation of a municipal electric-light plant in connection with the waterworks system.

BALTIMORE, MD.—The Consolidated Gas, El. Lt. & Pwr. Co., of Baltimore, has plans under way for an additional boiler house at the Westport power station. A 15,000-kw generator has been ordered from the General Electric Co., and orders have been placed with the Edge

Moor Iron Co. for six 1000-hp Edge Moor boilers. Plans are being prepared for construction of building and contracts will soon be awarded. The coal-handling plant will be increased during the winter, either by speeding up the present plant or by installing an entirely new system. A. S. Loizeaux is electrical engineer.

BALTIMORE, MD.—The contract for the construction of a 5-story and basement furniture factory, 34 ft. by 166 ft., with an ell 34 ft. by 58 ft., reinforced-concrete construction, has been awarded to the West Construction Co., of Baltimore. The building will be equipped for gas and wired for electric lighting and for motors for operating furniture machinery, freight elevators, steam heating, plumbing and sprinkler system. No power plant will be required as heat will be obtained from the adjoining building and energy from the local company. Bids for heating apparatus, electric wiring, elevator and sprinkler will be asked for later.

COLLEGE PARK, MD.—Bids will be received by the building committee of the Maryland Agricultural College, College Park, Md., at the office of the secretary of the college, until Oct. 20 for construction, including plumbing, heating equipment, electric wiring and fixtures, of a dormitory building. Drawings and specifications may be had at the office of Flourney & Flourney, architects, 152 H Street, N. W., Washington, D. C. A deposit of $50 will be required for specifications covering this contract, which will be refunded upon return of plans.

BENWOOD, W. VA.—The City Council has granted the Brooke El. Co. a 30-year franchise to furnish energy for lamps and motors in Benwood.

CHARLESTON, W. VA.—The Virginia Pwr. Co., of Charleston, is building a 26,666-hp plant on the Kanawaha River with steel-tower transmission lines to furnish energy to numerous mines in that vicinity. The cost of the plant is estimated at about $1,000,000. The company contemplates completing its hydroelectric power plant at Bull Shoal on New River, including dam 1400 ft. long and 125 ft. high, to develop 100,000 kw. It has three other power sites on New River, one at Bluestone, where it is estimated that 125,000 kw can be developed; the second at Richmond Falls, capable of developing 15,000 kw, and the third at Gauley Junction, where 30,000 kw can be developed. It is proposed ultimately to transmit energy to Cincinnati, Ohio, Huntington, W. Va., Portsmouth, Ohio, and Louisville, Ky. Wilbur Tusch is secretary and Charles O. Lenz chief engineer, 149 Broadway, New York, N. Y.

ALEXANDRIA, VA.—The Southern Ry. Co. is planning to erect a substation for a 4400-volt, three-phase transmission line to operate automatic electric block signal system. B. Herman, 1300 Pennsylvania Avenue, Washington, D. C., is chief engineer.

ORANGE, VA.—The Southern Ry. Co. is erecting a power station in Orange for emergency service, to be equipped with gasoline engine and generator. The company is installing an automatic electric block signal system between Seminary and Orange, a distance of 80 miles. B. Herman, 1300 Pennsylvania Avenue, Washington, D. C., is chief engineer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 21 for furnishing at the various navy yards and naval stations supplies as follows: Philadelphia, Pa., Schedule 5892—Furnishing and erecting two 10-ton, three-motor electric traveling cranes; Brooklyn, N. Y., Schedule 5890—10 radio receiving sets. Bids will also be received until Oct. 28 for furnishing at Puget Sound navy yard: Schedule 5893—One 5-kw, 125-volt turbo-generating set (steam pressure 140 lb.). Application for proposals should designate the schedule by number. T. J. Cowie is paymaster general.

North Central

DETROIT, MICH.—The Detroit Shipbuilding Co. has awarded a contract for the construction of a power house at its Orleans Street plant.

FENTON, MICH.—At a special election held recently the Flint El. Co. was granted a 30-year franchise to furnish electrical service in Fenton. Among the improvements contemplated is the erection of a new power plant. A 24-hour service will also be established.

GREENVILLE, MICH.—The R. J. Tower El. Co., of Greenville, expects to purchase within the next six months one 150-hp to 200-hp turbine waterwheel and material for concrete dam and flume. S. L. Tower is manager.

HUNTERS CREEK, MICH.—A deal has been closed whereby the Schlegel Lt. & Pwr. Co., of Lapeer, will furnish electricity for lamps and motors in Hunters Creek. Upon completion of the local system the company contemplates extending its system to Metamora.

ITHACA, MICH.—The managers of the municipal electric-light plant are considering the question of establishing a day service. Harry E. Churchill is superintendent.

LAPEER, MICH.—The F. J. Schlegel Lt. & Pwr. Co., of Lapeer, expects to erect within the next six months a new power house and to purchase new boilers, generators, turbines or engines, stokers and coal and ash-handling equipment, pumps, oiling system, switchboard, instruments, switches and protective devices, transformers, lightning arresters and electrical appliances, including vacuum cleaners, washing machines, etc.

BARBERTON, OHIO.—The Board of Control has awarded the contract for erection of the distribution system for the municipal electric-light plant to Fred Gangle, of Akron, for $46,850. Contracts for equipment for power house, etc., have also been awarded.

LOWELLVILLE, OHIO.—Bids will be received by the Board of Public Affairs of Lowellville until Oct. 25 for furnishing material and labor for rebuilding and extending the present lighting system in accordance with plans and specifications on file with the Board of Public Affairs as follows: (1) all materials as specified; (2) all labor required for removing the present material and the erection of new material.

MANSFIELD, OHIO.—The Mansfield Gas Lt. Co. has decided to enter the electrical field and work on construction of a new plant will begin in November. Two 750-hp natural-gas engines have been ordered for the proposed plant.

NEW CONCORD, OHIO.—The New Concord Wtr. & El. Co. has applied to the Ohio Public Utilities Commission for permission to issue $17,000 in bonds for improvements to its plant.

TROY, OHIO.—The town of Troy is considering the question of rebuilding the municipal electric-light plant next year. As yet nothing definite has been decided. L. A. Pool is superintendent.

LEXINGTON, KY.—The City Council is considering the question of issuing $200,000 in bonds for the purpose of establishing a municipal electric-light plant. The proposition will be submitted to the voters at the November election.

LOUISVILLE, KY.—The General Construction Co., it is reported, will install a $7,500 lighting plant in a large apartment house which it now has under construction.

WHITESBURG, KY.—The installation of an electric-light plant in Whitesburg is under consideration. Ira Fields, Jr., of Harlan, is reported to be interested in the project.

WINCHESTER, KY.—The pavement committee of the City Council is ready to award contracts for ornamental iron standards to be used in connection with the installation of a street-lighting system.

BEDFORD, IND.—The Southern Indiana Pwr. Co., of Bedford, expects to erect within the next six months two substations (750 kva each, 22,000 volts and 4000 volts) to feed stone mills and quarries in Bloomington (Ind.) limestone field. Energy is to be transmitted on a steel tower line (recently completed) from the Williams plant of the company, at 22,000 volts, a distance of 35 miles. The company also expects to purchase within the next six months material for 35 miles of 4000-volt distribution lines, consisting of wooden poles supporting No. 1 wire, in the Bloomington stone belt. D. J. Angus is manager.

NEWBURG, IND.—The local electric-light plant was recently purchased by Jennison and Schumaker. The new owners took possession Oct. 1 and contemplate making considerable improvement to the system during the coming year, including the purchase of a 30-kw to 33-kw, 250-volt generator.

ORLAND, IND.—R. E. Sanderson, owner of the local electric-light plant, expects to erect within the next eight months a cement block building for power house and to purchase a 75-hp boiler, a 60-hp or 70-hp steam engine, transformers, hoods and posts for incandescent street lamps and heating apparatus, etc.

TERRE HAUTE, IND.—The Terre Haute, Indianapolis & Eastern Trac. Co., of Terre Haute, expects to erect two additional high-tension transmission lines for connecting coal mines of the Deering Coal Co. and the Vandalia Coal Co., material for which has already been purchased. T. F. Grover is general manager.

COLLINSVILLE, ILL.—Plans for the installation of an ornamental street-lighting system have been presented to the City Council by the Collinsville El. Lt. Co. It is proposed to erect standards carrying five-lamp clusters. The cost of the installation is to be paid by the business men.

ELGIN, ILL.—The City Council has decided to call an election, to be held Oct. 16, to submit the proposition to issue $160,000 in bonds for the installation of a municipal electric-light plant in Elgin.

JACKSONVILLE, ILL.—Investigations are being made with a view of installing a heating plant in connection with the power plant of the Jacksonville Ry. & Lt. Co., owned and operated by the Illinois Trac. Co. The cost of the plant and mains is estimated at about $100,000. W. B. Miser is general superintendent.

MARINE, ILL.—Plans are being prepared for the construction of an electric-light plant for the Marine El. Lt. & Pwr. Co. Fred Scheurer is reported to be interested in the project.

MORRISONVILLLE, ILL.—The Southern Illinois Lt. & Pwr. Co., it is reported, contemplates improvements to its local electric plant, involving an expenditure of about $20,000.

JANESVILLE, WIS.—The Wisconsin Railway Commission has instructed the Janesville El. Co. to make improvements to its service and install new equipment.

LADYSMITH, WIS.—The Ladysmith Ltg. Co., it is reported, contemplates the installation of a new generator and other improvements to its plant.

MENOMONIE, WIS.—The City Council is considering two propositions for street-lighting, one for using electricity and the other for gas. If electric lamps are decided upon, ornamental street lamps will be erected on Main Street, at a cost of about $4,900. The present plans provide for 49 lamp standards.

MINERAL POINT, WIS.—The Mineral Point Pub. Ser. Co. expects to purchase within the next two months one 1200-kw Westinghouse (bleeder type) turbine, LeBlanc condenser, Stocker cooling tower and Rooney stokers under all boilers. F. C. Ludden is president.

MOSINEE, WIS.—The Mosinee El. Lt. & Pwr. Co. expects to purchase one transformer and some wire.

POYNETTE, WIS.—Plans and specifications have been prepared for the installation of electric-light plant and construction of a power dam. It is understood that bids will soon be called for construction work.

BROOTEN, MINN.—Bids will be received by John Bohmer, president Union El. Co., until Oct. 16, for the construction of an electric-lighting system in the village of Brooten. Plans and specifications are on file in the office of John Bohmer, president, of the Union El. Co., Brooten, and in the office of Earle D. Jackson, consulting engineer, Capitol Bank Building, St. Paul.

MADELIA, MINN.—A franchise has been granted to Thomas J. McGovern, of Mankato, to install and operate an electric-light plant in Madelia. Work will begin at once on the erection of a transmission line from Lake Crystal. Energy will be supplied from the dam at Rapidan. Ornamental street lamps will be erected on Main and St. Paul Streets, and incandescent lamps will be installed on all other streets.

MOORHEAD, MINN.—Application has been made to the Council by M. H. Davis for a franchise to construct and operate an electric-light plant in Moorhead.

MOUNTAIN LAKE, MINN.—The contract for lighting the city has been awarded to the Mountain Lake Milling Co. The cost of the installation of the system is estimated at about $10,000. J. J. Hiebert is manager.

NEW MUNICH, MINN.—Bonds to the amount of $5,000 have been voted for the installation of a municipal electric-light plant.

WARROAD, MINN.—The contract for the construction of the municipal electric-light plant has been awarded to the Northwestern Electrical Supply Co., of St. Paul, for $29,925. The contract includes building, electrical equipment, wiring, water mains around block 4 and Lake Street to State. The plant will be equipped with two 60-hp gas-producer engines and a 75-kw alternating-current generator.

WOODLAKE, MINN.—All bids received Sept. 25 for furnishing material and erecting a 13,200-volt transmission line from Granite Falls to Woodlake and a distribution system in Woodlake have been rejected. New bids will be considered by the village. Harry F. Payne is village recorder.

CORRECTIONVILLE, IA.—The power and milling plants of the Union Lt. & Pwr. Co., of Correctionville, were recently destroyed by fire, causing a loss of about $20,000. A new light plant, it is understood, will be erected at once.

CUMBERLAND, IA.—P. A. Johnson, proprietor of the Anita electric-light plant, has applied for a franchise in Cumberland. If granted a franchise, it is understood that a new plant will be erected in Anita and the transmission line extended to Wiota.

HAMPTON, IA.—The contract for street-lighting has been awarded to the Hampton El. Lt. Co. About 70 electroliers will be purchased, of which about 50 will be used in the business section and 20 in the residential districts.

McGREGOR, IA.—Arrangements, it is reported, have been completed for the installation of an electric-light plant in Monona, energy for operating the system to be supplied from the plant of G. S. Donaldson, of McGregor, 14 miles distant. A. Wellman, of Monona, to whom was recently granted a franchise to install a system here, will erect a substation at the city limits and purchase energy from the McGregor plant. Mr. Donaldson will erect the transmission line to the substation. The proposed transmission line will pass through the villages of Girard and Froelich.

MILFORD, IA.—G. F. Sheldon, of Sheldon, has applied for a franchise to install an electric-light plant in Milford.

MOORHEAD, IA.—Application has been made to the town of Moorhead by M. H. Davis for a franchise to erect a power plant.

PACIFIC JUNCTION, IA.—At an election held recently the proposition to grant the Red Oak El. Co. a franchise in Pacific Junction was carried. The company is now erecting its transmission lines west from Red Oak and will connect with the lines at Plattsmouth, Neb., the two companies consolidating. The transmission line will pass through Emerson, Hastings, Malvern, Glenwood and Pacific Junction. The company has been granted a franchise in Hastings and an election will soon be held in Emerson and Malvern.

SWANVILLE, IA.—The installation of an electric-light plant to furnish energy for lighting the city is contemplated by Albert Mielke.

WHAT CHEER, IA.—The What Cheer El. Lt. Co. expects to complete the erection of its 13,000-volt transmission line connecting with the Sigourney Transmission Co. at Delta within the next month. Material for the line has been purchased.

JEFFERSON CITY, MO.—The City Council has engaged R. L. Baldwin, consulting engineer, of Kansas City, to prepare preliminary plans for a municipal electric-light plant.

ST. LOUIS, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 30 for an electric elevator, including hoistway, etc., in the United States post office at St. Louis, Mo., in accordance with drawings and specifications copies of which may be obtained at above office. O. Wenderoth is supervising architect.

FESSENDEN, N. D.—Plans, it is reported, are being considered for enlarging the local electric-light plant.

ROLLA, N. D.—A franchise has been granted to John Munro for the installation of an electric-lighting system in Rolla.

MITCHELL, S. D.—Bids will be received by N. H. Jensen, city auditor, until Oct. 20 for material and labor for the construction and installation of a municipal telephone system in the city of Mitchell. Bids are to be submitted on the labor and material as a whole; also separate bids for each. Plans and specifications are on file at the office of the city auditor, copies of which may be obtained upon deposit of $5, which will be refunded upon return of same.

EXETER, NEB.—The Exeter El. Lt. & Pwr. Co. expects to erect within the next two months one 125-hp tubular boiler, one 80-hp Corliss engine and a 60-kw, 125-volt direct-current generator.

POLK, NEB.—Bids will be received by the village clerk for the construction of a complete electric-light plant and additions to the water-works system, including a 40-hp oil engine, 20-kw generator, 80-amp storage battery, switchboard and distribution system, 700 ft. 6-in. and 4-in. mains, 18 hydrants, valves, pressure tank and air compressor. Grant & Fulton, of Lincoln, Neb., are engineers.

ARMA, KAN.—Bonds to the amount of $26,000 have been voted for the first instalment on the municipal electric-light plant and water-works system. Bids for construction will be called in about six weeks. Albert C. Moore, of Joplin, Mo., is engineer.

CONCORDIA, KAN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 12 for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Concordia, Kan. Drawings and specifications may be obtained at the above office or from the custodian of site at Concordia, Kan. O. Wenderoth is supervising architect.

GLASCO, KAN.—The manager of the municipal electric-light plant expects to purchase within the next 60 days inside wiring material. C. H. Simpson is superintendent.

GYPSUM, KAN.—The Gypsum Lt. & Pwr. Co. expects to purchase within the next six months a 25-hp or 30-hp oil engine, underground conduit and cable for street-lighting system, ornamental street lamp-posts, washing machines, etc.

HIGHLAND, KAN.—The Home Tel. & El. Co., of Highland, expects to erect within the next two months 2200 ft. of No. 2 copper wire and to purchase self-starters for two 15-hp direct-current 220-volt motors, rubber-covered wire (from $250 to $350 stock), porcelain knobs, tubes, conduits, fittings and other wiring supplies; also within the next six months one 50-hp oil engine directly connected to a 37½-kw or 40-kw, 110-220-volt, direct-current generator. Work has begun on the construction of the Highland municipal water system, to be completed by Jan. 1, 1914. Energy for operating the pumping plant will be furnished by two 15-hp, 220-volt direct-current motors, energy to be purchased from the Home Tel. & El. Co. With this increase in load the company hopes to establish a day service within the next few months. J. H. Bender is manager.

ONAGA, KAN.—The Onaga Lt., Ht. & Pwr. Co. expects to erect within the next four months a 4½-ton ice plant to be operated in connection with its electric plant. All contracts for the work have been awarded. Ernest L. Frezieres is manager.

PEABODY, KAN.—The electric-light and ice plants in Peabody were recently destroyed by fire. It is understood that the plants will be rebuilt.

SABETHA, KAN.—The city of Sabetha has recently purchased a new 187-kva, three-phase, 60-cycle, 2300-volt Westinghouse turbine, several hundred new poles and a large amount of weatherproof wire for rebuilding the overhead distribution system. The city also proposes to install a new ornamental street-lighting system in the near future. F. W. Hunter is city engineer.

STOCKTON, KAN.—The city of Stockton expects to purchase within the next three months one 30-hp and one 15-hp pump directly connected to electric motors. O. M. Goodrich is chief engineer and electrician. F. A. Chipman is city clerk.

WHITING, KAN.—Bids will be received until Oct. 16 at Whiting for the erection of a transmission line and electric-light plant as follows: Section (A) For furnishing poles; (B) for furnishing pole material and wire; (C) for installation of plant; (D) for material and labor for transformer station. Plans and specifications are on file in the office of Henrici, Kent & Lowry Engineering Co., 715 Reserve Bank Building, Kansas City, Mo., or will be forwarded upon a deposit of $3. Frank G. Todd is city clerk.

Southern States

JACKSONVILLE, N. C.—The contract for the installation of an electric-light plant in Jacksonville has been awarded to the Newbern El. Sup. Co., of Newbern. The plant will furnish energy for street-lighting and also to private consumers. Luther Taylor, of Jacksonville, is owner.

RUTHERFORDTON, N. C.—The town of Rutherfordton is contemplating the installation of either an electrically driven deep-well pump

or an electrically driven air compressor and air lift apparatus in connection with the municipal electric-light and water plant. L. C. Gidney is superintendent.

WILMINGTON, N. C.—The Tidewater Pwr. Co., of Wilmington, expects to purchase within the next six months a complete conveying equipment for handling sawdust and heating duct to its boilers. Raymond Hunt is superintendent of electrical department.

LAKE CITY, S. C.—The City Council has engaged the J. B. McCrary Co., of Atlanta, Ga., as consulting engineers to take charge of the construction of the proposed municipal electric-light plant and water-works system. The work will involve an expenditure of approximately $12,000.

GORDON, GA.—The contract for the proposed municipal electric-light plant has been awarded to the Modern Equipment Co., of Savannah, Ga. The plant will be driven by a Foos oil engine.

HOMERVILLE, GA.—The Barnhill-Ferndon Co. has been granted a 30-year franchise to construct and operate an electric-light plant and water-works system in Homerville.

KISSIMEE, FLA.—The City Council, it is reported, is considering the installation of an additional generator in the municipal electric-light plant, to cost about $7,000.

LARGO, FLA.—Preparations are being made by J. N. McClurg, manager of the Clearwater ice factory, to construct and operate an electric-light system in Largo. Energy for operating the system will be supplied from the power house in Clearwater. A three-phase transmission line, 3 miles long, will be erected.

MIAMI, FLA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 1 for an electric passenger elevator in the United States post office, court house and custom house in Miami, in accordance with drawings and specifications copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

KENTON, TENN.—Bonds to the amount of $30,000 have been voted for the installation of an electric-light plant.

COLUMBUS, MISS.—All bids received Oct. 1 for installing an electric-light plant at the Mississippi Industrial Institute and College were rejected. As yet no time has been set for receiving further bids. D. T. Gaston is secretary and treasurer.

YAZOO CITY, MISS.—The Public Service Commission expects to purchase within the next three months one motor-generator set and a six-panel switchboard with instruments from the General Electric Co. James S. Butler is manager.

ARGENTA, ARK.—The City Council has granted the Merchants' Ltg. Co., of Little Rock, a franchise to furnish electricity in Argenta for a period of 30 years. The municipal electric-light plant will be closed down and energy for the local system will be supplied by the Merchants' company.

BOKHOMA, OKLA.—The installation of an electric-light plant, it is reported, is under consideration by the Wilson Lumber Co. W. M. Waterman is general manager of the company.

MEDFORD, OKLA.—Bids will be received by J. G. McKelvey, town clerk, until Oct. 15 for construction of a power house for water and light plant. I. H. Ruth is president of board of trustees.

SUPPLY, OKLA.—At an election held Sept. 29 the proposition to issue bonds for the installation of a municipal electric-light plant was carried. C. C. Devoe is chairman of board.

DALLAS, TEX.—The Municipal commission has awarded the contract for electric wiring the new city hall to the W. M. Clower El. Co. for $7,960.

DALLAS, TEX.—Bids will be received by the county auditor at Dallas, Tex., until Nov. 3 for the installation of heating and washed-air ventilating systems, also plumbing and elevators to be installed in the nine-story and basement criminal courts and jail building for Dallas County. Separate bids are to be submitted for plumbing and elevators; bids for power plant and boilers will be asked for later. Plans and specifications may be obtained at the office of H. A. Overbeck, architect, 501 Juanita Building, Dallas. A deposit of $50 will be required for plans, to be refunded upon return of same.

MERKEL, TEX.—The Merkel El. Co. expects to purchase within the next six months 250 25-ft. poles with 6-in. tops and within the next month it will purchase 20 posts for street-lighting. W. E. Britain is manager.

TEXAS CITY, TEX.—The proposition to issue $250,000 for the construction of an electric light and power plant and the purchase of the lighting and sewer systems of the Texas City Corpn. will be submitted to the voters in the near future.

VENUS, TEX.—The Venus Lt. & Wtr. Co. expects to purchase within the next six months a carload of poles. A. D. Frost is owner and manager.

VERNON, TEX.—The Texas Pub. Ser. Co. (Vernon division) expects to erect within the next three months a new power house and transmission line and to purchase a new engine and generator; auxiliary equipment not yet decided upon, poles, wires, etc. The Texas Pub. Ser. Co. recently took over the Vernon Lt. & Pwr. Co. A. E. Gilman is business manager.

Pacific States

EATONVILLE, WASH.—The only bid for the construction of the proposed municipal electric-light plant was submitted by Buxbaum & Cooley Co., of Seattle, at $14,000. The bid was rejected and the proposition awaits change in specifications or source of supply. Charles C. Beggs is town clerk.

KELSO, WASH.—A transmission line will be erected between Kelso and Castle Rock by the Washington-Oregon Corpn., of Chehalis. This line, when completed, will be the means of connecting a continuous line from Woodland to Tenino, also connecting the power plants at Chehalis and Kalama.

PUYALLUP, WASH.—The City Council is considering the proposition to purchase energy for lamps and motors from both the Tacoma municipal electric-light plant and the Stone & Webster Corpn. The cost of erecting a transmission line from the Tacoma plant to Puyallup is estimated at about $15,000.

SEATTLE, WASH.—The Seattle El. Co. is contemplating the construction of a coke oven at its plant at 2000 Northlake Avenue, to cost about $50,000.

SPOKANE, WASH.—The City Council has voted an appropriation of $5,000 to secure definite engineering data in regard to the construction of a municipal electric-light plant. C. M. Fassett, commissioner of public utilities, is a member of the committee appointed to make investigations.

TACOMA, WASH.—The contract for installing a power plant in the Lincoln Park High School has been awarded to the Washington Machinery Depot, of Tacoma, for $20,911. Alfred Lister is secretary of the school board.

ASHLAND, ORE.—The California-Oregon Pwr. Co., it is reported, will extend its transmission lines through the village of Suncrest and into adjacent territory. Energy will be supplied to the farmers along the line and to the Suncrest Orchard Packing Co. The work will involve the expenditure of several thousand dollars.

BAKER, ORE.—The Eagle River El. Pwr. Co., of Baker, expects to purchase within the next two months one 500-kw, 60-cycle, 2300-volt turbo-generator, complete with condenser, to be installed in auxiliary plant at Baker. J. K. Romig is vice-president and manager.

PORTLAND, ORE.—The City Council has decided to employ a hydro-electric engineer for the purpose of investigating various municipal lighting and power projects which Commissioner Daly of the Public Utilities Department has under consideration.

PORTLAND, ORE.—The Portland Ry., Lt. & Pwr. Co. expects to erect within the next 30 days a 500-kw motor generator set in its hydro-electric station at Bull Run to furnish energy to operate the Mount Hood division. O. B. Coldwell is general superintendent of light and power department.

THE DALLES, ORE.—The power plant of the Oregon Pwr. Co. was recently damaged by fire, causing a loss of about $1,500. It is reported that additions are planned when repairs are made.

BANNING, CAL.—The water-power of the Whitewater River will be utilized to generate energy by the Consol. Pwr. Co., of which H. Edwin Moore, of Los Angeles, is manager. The company has completed the diversion of the river from the desert, bringing the water in conduits 6 miles to a point near Banning, where several sections of land will be irrigated. Announcement is made by the officials for the company that two and possibly three power houses will be installed at points a few miles north of Banning in the early spring. Arrangements have been made for financing the project, aggregating $500,000, and preparations have been made for the work.

OROVILLE, CAL.—Work, it is reported, will soon begin on the construction of two additions to the Big Bend power plant of the Great Western Pwr. Co. on the North Fork of the Feather River at Las Plumas, 18 miles from Oroville, to cost about $1,000,000. The additional units to be installed will increase the output of the plant from 40,000 kw to 60,000 kw.

PALO ALTO, CAL.—The city of Palo Alto expects to purchase within the next six months a switchboard panel and equipment; also within the next 12 months material for distribution system (from $2,000 to $3,000 worth), and to expend about $3,000 for electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. Contract has been awarded for a 300-hp generating unit, consisting of Diesel engine and generator. J. F. Byxbee, Jr., is city engineer.

RED BLUFF, CAL.—The Secretary of the Interior has authorized the Reclamation Service to execute a contract with the Iron Canyon Project Association of California whereby the federal government is to make surveys and preliminary investigations to determine the feasibility of the Iron Canyon irrigation project, preparing plans and estimates of cost, etc. The proposition involves the construction of reservoirs on Sacramento River or its tributaries for the purpose of irrigating lands, mainly situated below the city of Red Bluff along Sacramento River; improvement to the navigability of the Sacramento River in the vicinity of the project, the prevention of floods in the Sacramento Valley, the development of hydroelectric power, etc., all being incident to the main plan of irrigating land in the Iron Canyon project. The expense is not to exceed $20,000, one-half of which will be borne by the association, the other half by the federal government.

SONOMA, CAL.—The Sonoma Valley Lt. & Pwr. Co. has applied to the State Railroad Commission for permission to issue $30,000 in bonds, the proceeds to be used to pay off existing indebtedness and for extensions to its system.

SUSANVILLE, CAL.—The Lassen El. Co., of Susanville, expects to purchase within the next three months one 75-kw, three-phase, 60-cycle, 2200-volt generator, complete with exciter, switchboard, synchronizing apparatus and Tirrill voltage regulator for 150-kw generator, all to be used as an auxiliary installation to the present plant. The company would consider good guaranteed second-hand machinery. L. R. Cady is general manager.

KELLOGG, IDAHO.—The Bunker Hill & Sullivan Mining Co., of Kellogg, is reported to be contemplating the installation of a new street-lighting system in Kellogg and Wardner to replace the lamps now in use. It is proposed to install tungsten lamps, at a cost of about $4,000.

FLORENCE, ARIZ.—At an election held recently the proposition to grant the Florence Improvement Co. a franchise to install an electric-light system in Florence was carried. R. G. Arthur, of Douglas, is general manager.

HARDIN, MONT.—Plans are being prepared by B. C. Lillis, of Hardin, engineer, for a large hydroelectric power plant to be erected on the Big Horn River.

New Incorporations

BLOOMINGTON, ILL.—The Consumers' Utility Co. has been incorporated with a capital stock of $10,000 by H. M. Stone, E. M. Hoblitt and H. H. Tenney.

UNION, MISS.—The Union Lt. Co. has been incorporated with a capital stock of $10,000 by J. M. Cole, P. L. Ratcliffe and others.

NEW LONDON, MO.—The North Missouri Lt. & Pwr. Co. has been chartered with a capital stock of $60,000. The company proposes to purchase energy from the Keokuk power plant to be delivered at the substation at Ilasco, 8 miles east of New London. The company will distribute electricity for lamps and motors in New London, Center, Perry and Frankfort, and also to the farmers along the transmission line. The directors are: M. C. Briggs and P. M. Megown, of New London; M. J. Jones and J. D. Pitt, of Frankfort; E. W. Keithley and J. Van Elzea, of Center; Samuel C. Gill and William Tibbles, of Perry.

PHARR, TEX.—The Pharr El. Lt. & Pwr. Co. has been chartered with a capital stock of $5,000. The incorporators are: S. R. Cawthrop, Marvin Evans, of Pharr, and A. K. McColl, of Kansas City, Mo.

TORONTO, ONT., CAN.—The Upper St. Lawrence Pwr. Co. has been incorporated with a capital stock of $3,000,000.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 30, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,074,125. METHOD OF OPERATING INDUCTION MOTORS; B. G. Lamme, Pittsburgh, Pa. App. filed July 6, 1908. Primary winding has a plurality of sections for each phase, sections being connected in different relations.

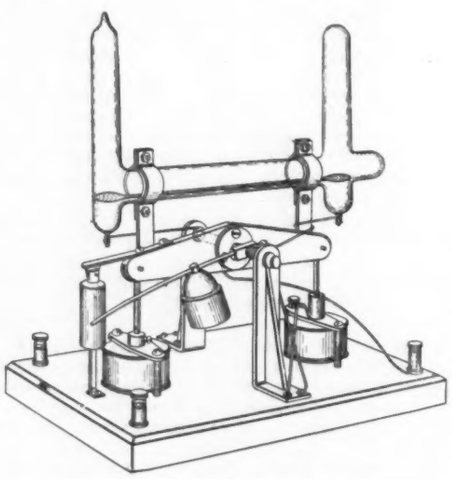
1,074,137. PRESSURE-ALARM GAGE; F. Schubert, Sellersville, Pa. App. filed Feb. 26, 1912. Bourdon tube type, with contacts; adjustment is inclosed and locked to prevent its being tampered with.

1,074,146. THERAPEUTIC ELECTRODE; R. H. Wappler, New York, N. Y. App. filed Dec. 5, 1912. Pressure on the electrode controls strength of current entering the body.

1,074,152. ALTERNATING-CURRENT MOTOR; H. L. Zabriskie, Westfield, N. J. App. filed Feb. 1, 1913. Small motor which may be run on alternating current from 133 to about 25 cycles, or on direct current of same voltage without any change in connections.

1,074,170. TELEGRAPHIC SYSTEM; J. Gell, London, England. App. filed Dec. 21, 1910. Exchanges, trunk-line connections between exchanges and local subscribers' connections at each exchange.

1,074,171. RECEIVER FOR AUTOMATIC TELEGRAPHIC SYSTEMS; J. Gell, London, England. App. filed Jan. 30, 1911. Morse or Wheatstone type of receiver in which the magnet and armature structure may be adjusted as a unit to give neutral, marking or spacing bias.



1,074,253.—Vapor-Electric Apparatus.

1,074,215. ELECTROTHERMOSTATIC REGULATORS; J. G. Schuirmann, Kent, Wash. App. filed May 20, 1912. Primarily for automatically controlling supply of energy to an electric heating pad.

1,074,216. ELECTRICALLY HEATED PAD AND THE LIKE; J. G. Schuirmann, Kent, Wash. App. filed May 20, 1912. The sections of the heating element are flexibly connected to permit the pad being folded.

1,074,218. FUSE DEVICE; A. E. Simmons, Sacramento, Cal. App. filed Feb. 10, 1913. Signal given when fuse is blown; fuse wire is renewable.

1,074,241. COMBINATION ELECTRIC SWITCH; Y. Burgess, Chicago, Ill. App. filed May 10, 1912. Has plurality of handles which must be placed in a certain definite relation to close the circuit; for auto-ignition circuits and the like.

1,074,253. VAPOR-ELECTRIC APPARATUS; J. T. H. Dempster, Schenectady, N. Y. App. filed April 27, 1904. Covers movable container for the liquid electrode and automatic means (shown as electromagnets) for moving the container to make and break the conductive connection between the electrodes.

1,074,262. ELECTRIC OSCILLOGRAPH; J. T. Irwin, South Kensington, London, Eng. App. filed Sept. 19, 1908. Measures the difference in pull produced by electrostatic pressure on two stretched diaphragms.

1,074,286. MICROTELEPHONE; W. B. Oliver, Collingswood, N. J. App. filed July 27, 1909. For aiding defective hearing; has the capacity for controllably selecting and amplifying certain sound vibrations, while minimizing others.

1,074,298. TELEPHONE REPEATER SYSTEM; H. E. Shreeve, Millburn, N. J. App. filed Feb. 24, 1912. Repeating apparatus is associated with the two ends of a link circuit in such manner that when the link circuit is connected with the main circuits it constitutes a connection between the two main circuits.

1,074,303. ELECTRICAL ILLUMINATION; E. Weintraub, Schenectady, N. Y. App. filed Feb. 9, 1907. Mercury-vapor arc is passed through a refractory tube of small bore in an exhausted space.

1,074,333. GLOWER FOR ELECTRICAL INCANDESCENT LAMPS; O. M. Throwless, Newark, N. J. App. filed Jan. 20, 1911. Filament composed of tungsten and oxide of aluminum covered with refractory metal.

1,074,338. DYNAMO-ELECTRIC MACHINE; C. E. F. Ahlm, Cleveland, Ohio. App. filed Feb. 14, 1910. Special method of supporting the pole pieces.

1,074,383. ELECTRICAL METAL-WORKING APPARATUS; A. F. Reitzel, Charlestown, R. I. App. filed May 13, 1909. Particularly for welding a seam by a step-by-step process.

1,074,392. ELECTRIC MOTOR REGULATION AND CONTROL; L. H. Thullen and F. W. Willey, Cincinnati, Ohio. App. filed Jan. 25, 1912. For securing good commutation and avoiding sparking on interpole motors.

1,074,396. RIVETER; F. J. West and H. W. Darby, Winnipeg, Manitoba, Canada. App. filed July 8, 1912. Electric hammer for riveting purposes.

1,074,408. APPARATUS FOR FUSING ELECTROLYTES; H. R. Craveth, Niagara Falls, N. Y. App. filed March 19, 1910. Has horizontally and vertically arranged electrodes which may be adjusted and replaced without interrupting the fusing process.

1,074,428. MEANS FOR OPERATING COCKS, VALVES AND THE LIKE FROM A DISTANCE; J. M. F. H. Gil, Paris, France. App. filed May 31, 1911. Valve-operating motor with starter located at a distance.

1,074,431. CIRCUIT-CONTROLLING CONTACT; E. M. Hewlett, Schenectady, N. Y. App. filed Oct. 29, 1910. Shunt contact for circuit-breakers; arcing takes place on carbon surfaces.

7,074,434. FUSE; J. W. Hooley, New York, N. Y. App. filed May 7, 1913. Renewable fuse inclosed in transparent case.

1,074,454. LIGHTNING ARRESTER; F. W. Peck, Jr., Schenectady, N. Y. App. filed Feb. 10, 1909. A closed electric circuit acting as secondary is placed in inductive relation to the discharge circuit.

1,074,459. ELECTRICAL CONNECTOR; H. W. Pogue, Decatur, Ill. App. filed March 21, 1912. Plug connection, particularly for sad-irons.

1,074,462. OZONIZER; F. H. Richards, Hartford, Conn. App. filed Dec. 10, 1912. Special mounting for the concentric tubes of the device.

1,074,512. CONTROLLER REGULATOR; R. Marx, Philadelphia, Pa. App. filed March 15, 1912. Requires the controller handle to be brought to a full stop and moved slightly back before it can be advanced to the next "point."

1,074,533. PUZZLE OR TOY; E. J. Schowalter, Racine, Wis. App. filed Nov. 20, 1912. Parts of a figure are moved about by means of a magnet.

1,074,544. THERMOSTATIC CIRCUIT CLOSER; C. V. Fite, Charlotte, N. C. App. filed Jan. 10, 1913. Thermostatic element moves a pivot circuit closer.

1,074,549. ELECTROLYTIC APPARATUS; H. Heinkel and W. Weber, Dusseldorf, Germany. App. filed June 16, 1913. Apparatus for continuously producing hydrogen peroxide.